Enlightenment Philosophies of Humans and Nature: Implications for Animal Agriculture

Julie Anne Ames

Department of Geography, School of Environment McGill University, Montreal

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ABSTRACT

This thesis will involve an examination of Enlightenment notions of humans and nature, and how these have been embedded in modern human activities. The thesis will focus on the key theories arising from: Hobbes and the materialists; Descartes and the dualists; and Newton and the classical economists. Particular ideas, concerning the natural philosophy of Descartes and Hobbes, and the physics of Newton and its impact on classical and neoclassical economists, will be examined. A broad historical trajectory of their ideas, and their influence, will be traced through time to today. The example of livestock agriculture, focussing on the practice of factory farming, will be used as a tangible example of the ways in which certain conceptions of humans, nature, and human-nature relations are now manifest in our modern society. Factory farming will be used as a centre piece to illuminate the ethical and animal welfare implications manifest in Enlightenment narratives. Data on global livestock agriculture drawn from the UNFAO Livestock's Long Shadow report 2006 will be used to reveal the myriad negative repercussions that livestock agriculture has had, and continues to have, on animals and the natural environment. The concluding chapter will weave together the ideas of the thesis, and offer a brief glimpse of alternative human-nature narratives which may be more conducive to the flourishing of intergenerational and interspecies life.

ABRÉGÉ

Cette thèse examine des concepts philosophiques sur la nature humaine et de l'environnement provenant des philosophes des Années Lumières. La thèse se concentre sur les théories de: Hobbes et les matérialistes; Descartes et les dualistes; puis Newton et les économistes classiques. Une trajectoire historique de ces idées et de leur influence sera donnée. L'agriculture moderne, en particulier l'élevage industriel, sera utilisé pour donner un exemple tangible de la façon dont certaines conceptions philosophiques de l'être humain, de l'environnement, et de l'interaction entre l'humanité et la nature se manifestent aujourd'hui dans notre société moderne. Selon notre thèse, l'élevage industriel moderne reflète ou révèle malheureusement bien des implications éthiques et des protections des animaux des philosophes des Années Lumières. Des données sur l'élevage industriel provenant de l'Organisation des Nations Unies pour l'Alimentation et l'Agriculture seront utilisées pour démontrer les multitudes répercussions négatives que l'agriculture moderne a eu, et continue d'avoir, sur les animaux et l'environnement. Le dernier chapitre comprend une synthèse des idées principales de cette thèse, et offre brièvement quelques narratifs ou discours alternatifs sur l'être humain et l'environnement qui pourraient conduire à un plus grand épanouissement intergénérationnel et interspécifique de la vie sur Terre.

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Chapter 1 Introduction

"The greatness of a nation and its moral progress can be judged by the way its animals are treated" - Mahatma Gandhi

Introduction

A human narrative, or worldview, serves as a crucial indicator of a peoples' journey through time and space. A narrative tells a story of who a people are, where they come from, and what they value. In general, a narrative is in constant flux - ever-changing to adhere to changing conditions. However, certain, more durable elements of a narrative may last for centuries, and have a profound influence on the course of history.

The Athenian Enlightenment in Greece was a distant precursor to the second Enlightenment in western thought (Hyland et al., 2003). The 17th and 18th century Enlightenment was a time of intellectual revolution and profound changes in the spheres of the social, political, and economic. There were various bodies of thought that arose at this time. One key qualification is that the theories and narratives derived from the Enlightenment incorporate many intricacies, paradoxes and contradictions. The Enlightenment cannot be amalgamated into one general narrative – theorists of this time consisted of heterogeneous groups. Their ideas cross a broad spectrum of paradigms, discourses and nations. For the purposes of this paper, "Enlightenment" will refer specifically to the late Enlightenment of the 17th and 18th centuries in Western Europe.

The western Enlightenment has arguably had the strongest influence on the modern North American human narrative. Notions of the self and how humans relate to nature have impacted human behaviours and activities in all spheres of life. These notions can be linked to three foundational thinkers and their body of influence during the Enlightenment: Thomas Hobbes (1588-1679) and the materialists, René Descartes (1596-1650) and the dualists and Sir Isaac Newton (1642-1727) and the classical economists (Ophuls, 1997; Nadeau 2003).

One qualification of the above three thinkers, which is deserving of discussion, is that their time is considered by some historians to be in the pre-Enlightenment period. Others call it the "Age of Reason" (Hampshire, 1956). Indeed, philosophy is a constant state of the human mind, and so any arbitrary boundaries drawn to delineate one time period, such as the Age of Reason or the Enlightenment, may have blurry boundaries.

Nevertheless, the philosophy and science of Hobbes, Descartes and Newton emerged at a time when reason, logic, and experiential knowledge were gaining momentum and religion, magic, and mysticism were losing the esteem previously held in societies. This is not to discount, however, the fact that certain Christian philosophers, such as Descartes and Blaise Pascal (1622-1663), neatly wove within their natural philosophy an account of the natural order that encompassed a place for God, and where man's place rested in nature in relation to God.

Another condition to note at this time was that there was no clear line drawn between philosophy and the natural sciences (Hampshire, 1956). "Natural philosophy" encompassed both metaphysics and physics alike. And indeed, the dominant philosophers at this time, including (but not limited to) Descartes, Baruch Spinoza (1632-1677) and Gottfried Wilhelm Leibniz (1646-1716), sought to provide an account of both the natural world, and where man rests within it. Nonetheless, any discussion of philosophy and environmental thought, which seeks to derive influence from a body of ideas to a set of current human activities, must include a degree of consciousness of what the philosophers and scientists were seeking to enable and accomplish in their work. So, for instance, natural philosophers in the likes of Descartes, Leibniz and Spinoza aimed at introducing mathematical rigor in the exploration of knowledge (Hampshire, 1956). They often did so using deductive or a priori reasoning methods.

Nevertheless, the ultimate aim of many Enlightenment thinkers was to enable humanity to divide the natural world and conquer it, to rise above the trials and tribulations caused by both nature and divisions of social class, to annihilate destructive natural forces and to enable the freedom, utility and comfort of the human enterprise.

A central objective that rests behind much of the motive to overcome natural forces can be described as the human idea of progress (Bury, 1920). The advancement of human knowledge and the "liberation of science and religion from the yoke of authority" comprised the engines of the notion of progress (Bury, 1920, p.65). Several key thinkers were front and centre behind this movement, the progress project.

Another way of framing this idea of progress is as a project of emancipation: natural philosophers sought to shake the shackles of religious dogma, class divisions, and injustice that had imprisoned or restrained generations of men and women.

As Bury (1920) highlights, the realm of human thought expanded in the 17th century – the advent of the Enlightenment:

"Ubiquitous rebellion against tradition, a new standard of clear and precise thought which effects even literary expression, a flow of mathematical and physical discoveries so rapid that ten years added more to the sum of knowledge than all that had been added since the days of Archimedes, the introduction of organized co-operation to increase knowledge by the institution of the Royal Society at London, the Academy of Sciences at Paris, Observatories – realising Bacon's Atlantic dream – characterise the opening of a new era." (Bury, 1920, p.64).

Indeed, this notion of "progress," took on a life of its own during the Enlightenment period and became a central driving force behind western humanity's pursuit of knowledge, freedom and utility.

In essence, then, the idea of progress is:

"a theory which involves the synthesis of the past and a prophecy of the future. It is based on an interpretation of history which regards men as slowly advancing – *pedetemtim progredientes* – in a definite and desirable direction, and infers that this progress will continue indefinitely. And it implies that, as the issue of the earth's great business, a condition of general happiness will ultimately be enjoyed, which will justify the whole process of civilization; for otherwise, the direction would not be desirable." (Bury, 1920, p.5).

The idea of progress relates to the (fallacious) notion that humanity has an insatiable need to increase the amount of luxuries (utility) in living, and to reduce the hard physical labour required for self-preservation and the pursuit of happiness. This goal holds even if it is at the expense of other living entities, as exhibited in factory farming.

Indeed, the factory farming industry today, which has evolved from animal husbandry in centuries past, serves as a cogent example of the idea of progress in practice. Man's utility is maximized and his costs are minimized if he can simplify and streamline the animal farming process. Once economies of scale are reached and maximum output can be made with minimum input, more people can (theoretically) be fed than ever before. Once the basic necessity of food is dealt with for humanity, specifically, the production of high calorie and high nutrient-content foodstuffs (such as that produced by animals) humans can focus their time, energy and resources on other areas of the human progress project.

However, factory farming is but one of many modern activities that have been influenced by Enlightenment thought. Our Enlightenment-based narrative, with its dichotomous notion of humans and nature, can be linked to a variety of other ecological problems faced by the planet today. Animal or, livestock, agriculture has expanded across the globe. Today, it exists as the largest use of global land cover¹. The livestock sector comprises 30 percent of land use cover at 3.9 billion hectares. This sector takes up 78 percent of all agricultural land and 33 percent of cropland (for feed crops) (UNFAO, 2006). As the demand for livestock commodities grows, so does the expansion of land devoted to livestock agriculture.

The ecological implications of animal agriculture, guided and enforced by the notion that humans are a separate entity from non-humans, have been profound and far-reaching. A myriad of negative ecological impacts have been the result including (but not limited to) soil erosion and land degradation, water pollution, the consumption of scarce water resources, loss of biodiversity, and an increase in the emissions of atmospheric greenhouse gases.

1.A. Research Objectives

The objections of my research were to (a) identify the ideas of key players in the Enlightenment period and dominant philosophies arising from

¹ This estimate includes the feed crops maintained specifically to feed livestock animals.

this time regarding the human self, nature, and human-nature relations (b) trace an historical trajectory of the influence that these philosophies have had on other dominant thinkers during and after the Enlightenment (c) connect these philosophies to the human behaviours and practices in the marketplace today (d) more specifically, examine the influence on, and implications of, these conceptions to the dominant approach to animal agriculture.

1.B. Structure

The structure of the thesis will be as follows. Chapter 2, entitled Enlightenment Concepts of the Human Self: Thomas Hobbes and the State of Nature, will examine the philosophies popularized by Hobbes regarding human nature in its natural state – i.e. when there are neither laws nor governing authorities to control and constrain human behaviour. Hobbes' description of human nature in its purest form is encapsulated in his "state of nature" concept. The sections of chapter one will be organized as follows: section A will cover the key concepts that Hobbes describes in *Leviathan* (1651), specifically the "state of nature"; section B will cover Hobbes' ideology of materialism and the impact it had on his work; section C will cover the impact that both his state of nature and materialism had on subsequent thinkers in the Enlightenment (specifically with regards to the development of political economy); section D will discuss the outcome of the influence of Hobbes' ideas on 20th and 21st century Western culture.

Chapter 3 of the thesis, entitled Enlightenment Concepts of the non-Human Other: Cartesian Mechanistic Physiology, will engage the reader in a close examination of Rene Descartes and the profound impact that he has had on modern conceptions of nature and how it is different from the human species, specifically the human mind. It will also be argued that this conception of the differences between nature (in the realm of extended things) versus humans (in the realm of mind) have laid the foundations for a modern society that treats the natural environment as a separate entity from human society. The outcome of such a perception has been the construction of societies and civilizations that are severely dislocated from, and dysfunctional to, the natural ecosystem. With this premise in mind, chapter 3 will be structured as follows: section A will cover Descartes' doctrine of nature as machine; section B will delineate Cartesian dualism and its divergence from Hobbesian materialism; section C will examine the Cartesian mechanistic physiology, and the motivations of this particular part of Descartes natural philosophy; finally, section D will examine the influence that Descartes mechanistic physiology has had on notable thinkers, and some foundational philosophies and that have gained dominance after his time (acknowledging the fact that Descartes himself built his metaphysics on pre-existing dualisms from western culture, with deep roots in the Greek Enlightenment and Judeo-Christian tradition).

This brings us to chapter 4 of the thesis, which will be an examination of Newtonian Science and its impact on philosophy and economics. Specifically, this chapter will involve a conversation about the ways in which both the structure and laws of Newtonian science were transferred by classical economists to the burgeoning study of economics. From here, we will look at how neoclassical economics evolved from classical economics to the current market system.

The market today is very conducive to, and arguably requires, the ethic of efficiency and lack of animal ethics exhibited in the factory farming system. Hence, the title of chapter 4 is "Classical Economics, Neoclassical Economics: The Role of Newtonian Science." Section A will discuss the basics of Newtonian science, and the ways in which it was transferred to classical economics, focussing specifically on the metaphysics of deism, ontological dualism, and the French moral philosophers. Section B will examine the influence that Newtonian science had on a key founder of the modern neoclassical paradigm, Adam Smith. Finally, section C will examine the evolution of classical economics to the neoclassical economic paradigm in the 19th century, paying particularly close attention to the notion that natural laws function within the (economic) system, with atomized (economic actor) parts.

Chapter 5 of this thesis, entitled Case Study of a Modern Implication of Enlightenment Philosophies: Factory Farming, will highlight in detail the various embodiments of the philosophies outlined in chapters 2, 3 and 4 and their influence on a human land-use activity today: animal agriculture. Section A of this chapter will provide a general overview of the factory farming industry in North America. Section B will connect factory farming to Hobbesian materialism and his state of nature; section C will link the Cartesian mechanistic physiology to factory farming; section D will examine the role that the current neoclassical market has in reinforcing the factory farm industries and the joint crises of (a) animal suffering and (b) ecological decline that it contributes to. This section will illuminate how neoclassical economics rests on many assumptions birthed during the Enlightenment.

Finally, after the critical examination of these three Enlightenment thinkers, their theories, their influence, and the connection to factory farming, this thesis will give an in-depth discussion of the ecological implications of the human-nature dichotomy vivified during the Enlightenment. Chapter 6 will be largely based on the UNFAO Livestock's Long Shadow report (2006) and will be organized as follows: section A will document land use changes and land degradation that is a direct result of livestock agriculture; section B will examine the direct impact that livestock agriculture has had on water resources and water pollutants; section C will discuss the indirect effect that livestock agriculture has had on global species abundance and biodiversity; section D will provide a brief overview of the ways in which livestock agriculture contributes to climate change. The chapter will give more depth to section B on water issues related to animal agriculture, in order to highlight in more detail the direct influence that this activity can have on landscapes.

The final concluding chapter, chapter 7, will give a summation of the issues discussed in chapters 2, 3, 4, 5 and 6. It will also open for the reader further discussions of alternative human-nature narratives that may offer an exit to the decline in life's prospects. The conclusion seeks to inspire the reader to search for alternative notions of humans and nature found in both new movements and past traditions, and that are more conducive to the flourishing of all interspecies and intergenerational life.

Chapter 2

Enlightenment Concepts of the Human Self: Thomas Hobbes and the State of Nature

"During the time men live without a common power to keep them all in awe, they are in that condition which is called war; and such a war as is of every man against every man" - Thomas Hobbes, Leviathan, ch. XIII

Introduction

In this chapter, we will examine arguably one of the most influential thinkers of our modern era – Thomas Hobbes (1588-1679). Hobbes was born in Wiltshire, England during the Spanish Armada of Elizabeth I's reign (Hyland et al., 2003). During the Spanish Armada, the Spanish attempted to invade England and overthrow Elizabeth I after years of naval warfare between the two colonial countries. The English launched a fire ship attack and managed to drive the Spanish fleet back. In 1589, England launched Counter Armada against Spain.

Hobbes was also greatly affected by the Spanish Inquisition and the bloody Thirty Years War (1618-1648), in which the Protestants were pitted against the Catholics – both parties aiming to win religious supremacy through militancy. The civil war in England helped firm his belief in the "state of nature," "social contract" and in the monarch as the most effective ruling power.

Hobbes' work was profoundly influential on subsequent Enlightenment thinkers. Karl Marx declared Hobbes "the father of us all" due to his proposition that politics ought to be severed and placed in a different realm from religion and morals (Ophuls, 1997).

This chapter will be organized as follows: section A will discuss Hobbes' foundational notion, the state of nature; section B will outline Hobbesian materialism; section C will trace the influence that both Hobbes' state of nature, and his materialism, has had on notable thinkers to follow him namely John Locke (1632-1704) and Adam Smith (1723-1790); section D will relate the state of nature to pathological narcissism, and examine the link between his theory and a clinical illness of our time (with symptoms that include the obsession with the self, the social ethics of possessive individualism, competitive individualism, nihilism, and the dogmatic faith in infinite economic growth).

2.A. Hobbes and the State of Nature

Given events experienced in his upbringing (Spanish Inquisition, Thirty Years War) it is not surprising that Hobbes had a disenchanted view of human nature. Hobbes grew up in time of civil unrest, war and conflict. He felt that men and women were not naturally good, but that they were naturally reasonable (Ophuls, 1997). However, the passions of men and women were more powerful than their sense of reason. Without a sovereign polity, individuals pursue self-interest. Hobbes renounced the idea of politics having a moral imperative in favour of a polity that enabled its citizens to pursue the "good life". He felt that permitting individual citizens to pursue their individual happiness as they understood it would ensure the best possible outcome for society as a whole.

At the foundation of Hobbes' polity was the notion that humans are isolated, individualistic social atoms (Ophuls, 1997). Hobbes' ideas about the natural state of man were encapsulated in his influential work, *Leviathan*, published in 1651, where he explicitly describes his idea of the human with his concept of the 'state of nature'. Hobbes believed that "during the time men live without a common power to keep them all in awe, they are in that condition which is called war; and such a war as is of every man against every man" (Hobbes, Leviathan, ch. XIII).

Hobbes' state of nature referred to the ways in which humans behave in their natural state, when the powers of the government are not in place to control or regulate their actions (Zagorin, 2009). In this situation, humans are solely interested in self-preservation, and they have the right to whatever actions may preserve themselves, as well as their individual liberty. Men and women will use any means necessary in order to ensure their own preservation, including violence. Each human being is innately asocial, favouring combat over cooperation in order to further him or herself. Men and women are thought to act according to reason (though it could be argued that there is little rationality to selfishness and individualism). However, they are also desirously passionate and uphold insatiable needs. Passion reigns supreme over reason in the state of nature, and human passions are manifested in conflict and struggle. Life itself is a power struggle – and the state of nature is a state of war.

Hobbes used the analogy of a race when describing human life, stating that humans had "no other goal or garland, but being foremost" (Hobbes, 1651, 9.21) (Zagorin, 2009). Hobbes' notion of the competitive nature of humans can be summed up in the following passage (Hobbes, 1651, 11.2):

"So that in the first place I put for a general inclination of all mankind, a perpetual and restless desire of power after power, that ceaseth only in death. And the cause of this is not always that a man hopes for a more intensive delight than he has already attained to, or that he cannot be content with a moderate power, but because he cannot assure the power and the means to live well which he hath present, without the acquisition of more."

In this statement, Hobbes' 'power' refers to the ability and extent to which a man (or woman) can pursue resources and preserve the self.

My main argument surrounding Hobbes was not that his *Leviathan* was causative for modern industrial activities, but rather, that his concept of the state of nature has had a strong influence on modern economic theory and practice. Considerable literature exists on the foundational influence that Hobbes' state of nature had – *Leviathan* having been written during the birthing period of modern political economy. *Leviathan* represents the ideal political society to Hobbes. In this world, the monarch has absolute constitutional authority, in a police-state type government. This is needed in order to reign in the passions and self-interest of the common people. Without the sovereign state and political powers it entails, the people are in the state of nature (natural state/war state). Society would turn to internal chaos and anarchy. Therefore, the *Leviathan* construct is a way of reigning in on individual passions and the state of nature for the betterment of society as a whole.

Hobbes' state of nature, paired with other seminal, but very diverse, pieces around that time period (such as Niccolo Machiavelli's (1469-1527) *The Prince* (1532)) marked a turning point in thought about the nature of the human being (Ophuls, 1997). Great western thinkers and writers before generally assumed humans to be moral creatures who put communities before individuals. Extending further back in history, arguably the majority of ancient and medieval civilizations (Greece partially excluded) emphasized the needs and objectives of the collective whole over the individual. However, conditions arising from the Renaissance created fertile ground for Hobbes' argument that human nature was innately and justifiably self-interested, focussed on selfpreservation and gratification, asocial and isolated from its environment.

Hobbes was also a materialist, reducing all biota and abiota in the environment to matter and motion. To Hobbes, reality consisted in only two forms: matter (which included body, and which all entities were made of) and motion (which included human cognition and sensory perception) (Zagorin, 2009). Hobbes' materialism is prominent throughout *Leviathan*, "every part of the universe is body, and that which is not body is no part of the universe. And because the universe is all, that which is no part of it is nothing (and consequently, nowhere)" (Hobbes, 1651, 46.15). Science, particularly logical positivism, was paramount to Hobbesian philosophy. He believed that anything that could not be calculated or measured or was not empirical, was not reality.

Hobbes' materialism fit snuggly into his political agenda (Lynch, 1991). He reduced everything to either matter or motion as a universal scientific hypothesis. Hobbes' materialism suppressed ideas such as conscience and empathy, thereby making it necessary for a political power to be put in place to guide society and prevent citizens from succumbing to the state of nature (Finn, 2006).

Indeed, Hobbes was fascinated by reason, the scientific method, and the application of science to politics. His mechanistic materialism enabled the explanation of natural and societal phenomena in scientific terms (Finn, 2006). It also brought on a lively and impassioned debate between him and Rene Descartes. Descartes believed that the immaterial mind was the essence of human existence, which served as an assault to Hobbes' argument for a stable

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polity devoid of theology. Hobbes vehemently debated Descartes metaphysical notions, attempting instead to ground them in his materialistic hypothesis. He prudently maintained that every aspect of the universe, including the human mind, was nothing more than the sum of its parts – little balls of matter that moved and interacted. Anything that did not fit into this equation did not exist.

2.B. Hobbes' Influence on John Locke, Adam Smith, and Others

Hobbes' elimination of moral virtue and theological underpinnings from the realm of polity was highly influential on subsequent philosophers' works. Ophuls (1997) traces the influence of Hobbes' ideas about the true character of humans in their nature state and how this state of nature related to the political economics that evolved thereafter.

John Locke (1632-1704) used Hobbes's state of nature and social contract in order to formulate the basis of his political economy. Though his *Two Treatises of Government* (1690) invert many of Hobbes' ideas, he still draws on the core notion that human beings are creatures predominantly governed by their passions and their instinctual drive for self-preservation and satisfaction. However, unlike Hobbes, he felt that conscience and rationality were often enough to keep these passions under control, despite there being a politics to do just that in place. Locke also built upon Hobbes' foundational value of political economy – that material satisfaction is the ultimate end of politics and economics, progress and development. For Locke, life, liberty, health, and estate were the natural rights of man. Freedom of religion was another crucial concern. Private property captures his notion of goods in society. The goods incurred by society through private property rights were both political and social, and served to be the basic tenant of his liberal politics.

When man held property rights, he could better avoid famine and other hardships and disease and could gain greater amounts of wealth.

Adam Smith (1723-1790) prepared his influential *Wealth of Nations* (1776) drawing notions of self and polity from Hobbes and Locke (Ophuls, 1997). Thus, Smith essentially agreed with Hobbes' definition of human nature in the *Wealth of Nations* (though he diverges in *Moral Sentiments*). Smith, on the other hand, felt that the natural human state was less of a problem to be controlled and more of an advantage to the greater good of society. The state of nature provided the foundations for individuals competing in self-regulating markets.

Smith hypothesized that the "invisible hand" of the market would guide the market economy and enable it to reach a state of equilibrium. The "invisible hand" hypothesis assumes that each actor in the market will act as an isolated individual and compete with other actors in the marketplace. To Smith, market outcomes would be most favourable when each action taken by actors relates to each individual actor's objective of maximizing personal utility or satisfaction.

Smith legitimized Hobbes' state of nature by neatly weaving it into his market economy theory. He too believed that self-interest was what kept societies alive and functioning in a way that generated fairness and equality (Ophuls, 1997). As Smith states, "It is not from the benevolence of the butcher, the brewer, or the baker, that we expect our dinner, but from their regard to their own interest," (Smith, 1776). He later argues, "Every man, as long as he does not violate the laws of justice, is left perfectly free to pursue his own interests in his own way, and to bring both his industry and capital into competition with those of any other man, or order of men," (Smith, 1776). Smith's intentions for reinforcing individualized self-interest were arguably noble – he thought that it would enrich society as a whole (Ophuls, 1997). Indeed, his laissez faire economic policy, which reinforced and legitimized Hobbes' state of nature, became pivotal to the formation of the modern day market economy. Yet, ironically, years before he wrote the *Wealth of Nations*, Smith wrote *The Theory of Moral Sentiments*, published in 1759. In this work, he wrote that "great property" could lead to "great inequality" and was opposed to purely self-interested economic pursuit. In any case, Smith still resolved to follow the model proposed by Hobbes in his market theory – advocating for the self-interested pursuit of utility by the economic agent.

Both Locke's *Two Treatise of Government* and Smith's *Wealth of Nations* became key texts in the evolution towards a market society and modern day neoclassical economics (Ophuls, 1997). As discussed, both texts rested on Hobbes' foundational assumptions about the nature of the human and his conduct in the market. Subsequent thinkers after Smith continued in this tradition. For instance, Karl Marx (1818-1883), a key detractor of the bourgeois political economy, maintained his critique of society using Hobbes' assumptions about the nature of the human. He also came to similar conclusions about how to manage a society of egoistic individualists. Marx advocated for a dictatorial society, based on Hobbes' notion that without which, society would be in turmoil. Though ideologically divergent, Marx too held continuity with the likes of Smith, Locke and Hobbes with his vehement materialism. However, in brief and simplified terms, he also emphasized how everything could be reduced to production and consumption, labour and capital.

In fact that there is evidence proving that Marx, along with Locke and Smith, drew on the state of nature is significant our modern human narrative,

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as well as to today's market-oriented society. Ophuls (1997) argues that the actualization of Marx's work was a heightening of liberal values, and valuing of the relations of productions. At the core of this is the "basic image of man – individualistic, materialistic, hedonistic" (Ophuls, 1997, p.42). Left unchecked, these characteristics would lead to chaos. But with a dictatorial power in place, and with scarcity abolished through use of the copious abundance of nature, mankind would progress and prosper. Indeed, it seems that Marx, along with Locke, Smith and other foundational thinkers at the time of Enlightenment (including Francis Bacon (1561 - 1626)) were closely aligned with the idea and project of improving human "progress" (Bury, 1920).

Thus, the historical trajectory which can be traced from Hobbes through to Marx demonstrates the construction of modern narratives of man which were founded from Enlightenment thought. Hobbes, with his premises on the nature of the human and its manifestation when devoid of polity, laid the groundwork for Locke's theory of property, Smith's theory of the market economy, and Marx's communism (which, though it is less apparent, also has had profound implications on modern dogmas and the human narrative²) (Ophuls, 1997).

2.C. Hobbes and the Materialists' Influence Today

Today, the individualistic, materialistic, self-satisfying market actor, also known as the modern day consumer, can be conceived of as *homo economicus*.

² Not only do they share premises on the nature of man, but the common thread of this fabric of thinkers is the requirement that humans must continually appropriate resources from the environment in the pursuit of "the good life." Today, it is considered practical, efficient and even moral to take "materials" from the Biosphere and to transform them into a human "good". Any biota or abiota, even humans at times (specifically those with less material wealth) are viewed first and foremost in the market economy as having production potential.

Homo economicus is a term used by critics of neoclassical economics to characterize the way humans are expected to act in the market, and indeed, the way that they act naturally in a laissez faire market economy. The characteristics of *homo economicus* have been transcribed as the norm of behaviour for each individual today. The ultimate pleasures for *homo economicus* are material and power gain (Persky, 1995).

In a society dominated by corporate conglomerates and transnational enterprises, people once conceived of as citizens, are now predominantly treated by governments and private enterprises as consumers. The market economy has swollen to become powerful enough that it outweighs the spiritual and even the political spheres of life. Consumer culture is the dominant culture. The fact that the status quo rests largely within the realm of the market fortress has profound implications for the ethics underlying human treatment of non-humans, and the biosphere in general.

If city skylines are any indication of the supreme values of society, then Montreal or any major North American metropolis illuminates a chronology of values through time. Before colonization, what is now Montreal existed as a First Nations village. The people living here were an agrarian society supplemented by hunting, fishing, and gathering. They lived in long houses made from the evergreens that sheltered them; the skyline was dominated by trees. The first European explorers came to Montreal in the 1500s. Gradually, over several centuries, the native land and people were colonized. Montreal's vast coniferous woods were transformed into a burgeoning fort, then village, then town, then city. As increasing numbers of Europeans flooded in numerous churches and cathedrals were erected throughout the city. Their towers dominated the skyline of Montreal from the 17th until the 20th century. For instance, the Notre Dame Basilica, Montreal's oldest cathedral, was erected in 1656. But since the 20th century, the skyline has been dominated by corporate skyscrapers. Today, Montreal's tallest building, located at 1000 de la Gauchetière towers over the rest of city at 205 meters. It was built jointly by Bell Canada Enterprises and Teleglobe in 1992.

The necessary factor fueling the current and untenable rate of economic growth is the natural environment and its cornucopia of resources. But nature is conceived of as resting outside of the realm of humanity, more of a cherry tree to pick from than a unified entity that connects humans to all other biota and abiota. What is derived from nature is conceived of as a resource or commodity, rather than a part of our common heritage.

Homo economicus today can be traced to Hobbes' state of nature and materialism. *Homo economicus* has shaped the neoclassical market economy into what it now embodies, while the market economy, in turn, legitimizes *homo economicus* and influences human behaviour (Percy, 1995). Hence, both the idea of *homo economicus* and the institution of the market are self-reinforcing. Ophuls (1997) argues that Hobbes' state of nature has effectively become a self-fulfilling prophecy³. But the consequences for the Biosphere and a multitude of species inhabiting our planet have been disastrous.

2.D. Hobbes' Narcissistic Man

In the previous section, I articulated how Hobbes' state of nature has carried through to today. It has laid the basis for the notion of *homo economicus.* But a society whose notion of personhood is founded on the ideals of hedonism, individualism and materialism is in grave danger (Ophuls, 1997).

³ Perhaps Ophuls (1997) is somewhat too sweeping in his argument that the state of nature has manifest in reality in today's society. Hobbes can also be conceptualized as the father of modern notions of what it is to be human, specifically a human navigating a market society.

Our danger today exists in the form of the dual crises of the ethical and ecological (more of which will be discussed in chapters 5 and 6).

Hobbes' state of nature arguably developed into a self-fulfilling prophecy, breeding a society of people whose main aspiration in life is to "have a good job," be wealthy and to lead the good life. Any values of collectivity, cooperation or communitarianism are secondary to our primarily individualistic modern society.

However, a serious deficiency lurks in the state of nature realized today. Interestingly, evidence can be drawn from the psychiatric literature that links the characteristics of Hobbes' "man in natural state" to pathological narcissism. As Glass (1980) contends, much in the conception of the modern self, of the "me-ism" prominent in mainstream society correlates directly with both Hobbes' state of nature and clinical symptoms of pathological narcissism. His concept of the natural condition has been realized in contemporary states of mind and resulting behaviours. These include the obsession with the self, the social ethics of possessive individualism, the preoccupation of competitive or "getting ahead" in life, the epidemic of apathy, the amoral nature of economic psychology, the nihilism, and the popular notion that "the sky is the limit" or "anything is possible" (Glass, 1980, p.335). As Glass (1980) describes:

"What appears today as rampant narcissism, a psychological state of nature affecting all aspects of social and economic life should be understood not as a natural outgrowth of human development but as a pathologic outburst of energy that depends on the relation established between intra-psychic and interpersonal (social) elements. Hobbes' state of nature mirrors these modern psychic structures; it is a theory whose behavioral properties dominate modern consciousness." (p. 335-336) Glass (1980, p.335) cautions that the "psychological limitlessness" of modern mind is alarming because it can lead to the decay of a civilization to a "mindless, random exchange of energy." Yet he also notes that the effect dominates modern society. The outcome can be felt in the ecological crisis – where biophysical limits have been transgressed for the gain of few but at the expense of many. The outcome of this "psychological limitlessness" of the modern mind will be discussed in chapters 5 and 6.

Hobbes' vision of the natural state of man, versus man in a decaying state connects decisively with psychoanalytic psychological definitions of character deficits versus normal developmental phases, respectively:

"Psychoanalytic psychology and its adaptation to narcissistic personality disorders identifies pathology where Hobbes locates the motion of "levers and pulleys," the movements of ego described as appetite and endeavor. It finds characterological deficits where Hobbes discovers the mechanism of "will" and willing. The clinicians see sickness where Hobbes portrays actions. Hobbes situates the beginnings of human nature in a mechanistic, primitive psychology; the clinical theoreticians trace the history of the self through both its interpersonal developmental stages and its often irregular and traumatic intra-psychic conflicts. Hobbes envisions the self as an extension of internal mechanisms assimilating and mediating sense; the clinicians describe a deeply hidden internality, with symptoms requiring a complex deciphering that is dialectical rather than mechanistic. For Hobbes the internal world of dreams and imaginings represents "decaying sense," phantasms without meaning; for the clinicians the projections of the self in the form of fantasy, dream, and symbol contain clues to deeper meanings and structures in the unconscious." (Glass, 1980, p.337)

Like the pathological narcissist, the man in the state of nature is devoid of empathy, ethics, and compassion. An appreciation and respect for the autonomy of others is non-existent. Restraint and an understanding of limits are absent. Motivation from person to person is completely structured around the calculated pursuit of limitless passions and desires. Others are considered to be a threat if they are perceived to, in any way, impose upon the agent's motivations. If another living entity is not a threat to this endless game, then he/she/it is appropriated as an object, a tool of sorts, to be manipulated to assist or enable in the individuals' endless pursuit of satisfaction.

Pathological narcissism also appears in modern institutions that promote competition, growth, striving, and that see ethical restraints as barriers to the bottom line business imperative (Glass, 1980). It is interesting to note that the normative behaviours of both man and corporation encompass Hobbes' state of nature. Coupled together, the Hobbesian man and corporation is a lethal pair with the ability to plunder the Biosphere with little or no regard for other entities.

Hobbes' man in the state of nature is a natural predator who replaces internal feelings and conscience with the endless pursuit of power (Glass, 1980). There is no room for reflection or self-speculation. Rather, the "Hobbesian monad searches for others to devour, assimilate and devalue" (Glass, 1980, p.345). Knowledge is derived from action (motion) or from appropriating entities or things (matter). The predatorial Hobbesian monad transmutes society into a race, where each citizen is pitted against the other.

The Hobbesian monad shares with the pathological narcissist the devaluation of everything in the Biosphere (humans, biota, and abiota) into a commodity. Glass (1980) argues that commercial society and epidemic possessive individualism are the products of Hobbesian theory. Possessive individualism has taken over all spheres of human life – the social, political

and economic – and is the motor engine behind our market society's story of growth and progress.

What is more, the current cultural milieu exalts possessive individualism and its manifestations. Traits such as competitiveness, individualism and autonomy, isolation in order to pursue objectives, decisiveness, efficiency and individual success and achievement are lauded. Institutions uphold and reinforce these values such that they have become a part of the dominant paradigm of desirability. Characteristics of pathological narcissism have also become the norms for success, prosperity, excellence and desirability. The Hobbesian individual is bereft of relatedness or interconnectivity of any kind – whether it is to other humans, non-humans or nature. All that exists and matters to him is himself as an isolated, asocial atom, and his motivation for power and preservation.

Conclusion

Homo economicus serves as a cogent critique of the many destructive issues linked to the cultural upbringing of economic actors. Indeed, many of the characteristics of homo economicus are grounded in the man in the state of nature. It could be argued that Hobbes' state of nature became a selffulfilling prophecy – children raised in western society have been taught to believe that it is natural for them to hold individualistic, hedonistic, materialistic values. Furthermore, if they adhere to these 'natural' characteristics of their being, they will be rewarded in the market. The market too, will reach a state of equilibrium if everyone acts in their "natural way." Under these conditions, society can most effectively progress.

The principles endorsed by Hobbes lived on in the works of Enlightenment thinkers who followed him. Locke drew on the state of nature, as well as the social contract, for his treatises on property rights; Smith wove the state of nature into his foundational theories about the market economy; and even Marx drew on the state of nature in the formulation of his theories on communism.

It can be argued that Hobbes' state of nature were the stepping stones to a society that is more interested in self, self-preservation, and selfaccumulation, than the well-being of other living entities (including other humans, non-humans, and the ecosystem). In chapter 4 we will re-examine how the state of nature has influenced our human notion of self-hood and human behaviours in the context of the marketplace⁴.

⁴ In chapter 4, we will look specifically at how the state of nature influences economic actor approaches to non-human "commodities."

Chapter 3

Enlightenment Concepts of the non-Human Other: Cartesian Mechanistic Physiology

"Find a practical philosophy by means which, knowing the force and the action [of natural phenomena], we can ... employ them in all those uses which they are adapted, and thus render ourselves the masters and possessors of nature."

- René Descartes

Introduction

In this chapter, I will discuss René Descartes (1596-1650) and the impact that his theories have had on modern notions of self and nature. Descartes was born in La Hayre, France to a lawyer and provincial parliament member, and his wife (Stanford Encyclopedia of Philosophy, 2007). Descartes' mother died just after his first birthday – he and his siblings were left to be raised by his grandmother. In his youth, he joined the military as well as attended the University of Poitiers in France to pursue his Baccalaureate and License in Canon & Civil Law. However, he abandoned both in favour of philosophical pursuits.

Descartes is often referred to as the "father of modern philosophy" due to his revolutionary philosophical enterprise. Descartes' cosmology laid the foundational underpinnings for cosmologies of the Enlightenment up until Newton (Gaukroger, 2002). He was the first philosopher in the late Enlightenment (Aristotle having done so in the Greek Enlightenment) to detach mythology from philosophy of nature and the origins of the Earth, as well as to speculate on the mind. He had a wide span of interests, from geometry and mathematics, to metaphysics and mechanistic physiology. He also helped to found modern geometry. Of interest in our discussion will be Descartes` metaphysically grounded philosophy of science and nature (which he used as grounds for his philosophy of morality). His philosophy of science can be predominately found in *Le Monde* and *L'Homme*, which he published between 1630 and 1633. Further ideas and passages of interest are in his *Discours de la Method*, published in 1637 (this work is considered by many to be a foundational text of Enlightenment thought). Theories and doctrines from these works were foundational to the Scientific Revolution that was to follow.

The chapter will be organized as follows: section A will describe Descartes mechanism and the way in which he reduced all parts of nature to mere automata or, a machine; and section B documents the Cartesian mechanistic physiology, his motivations for this philosophy, and some of the influence that he had on other philosophers of the time and thereafter.

3.A. Descartes and Nature as Machine

Like Hobbes, Descartes was a mechanist – he reduced everything to functioning parts of matter. As discussed, Hobbes also reduced everything to corporeal substance or matter (even the human mind) and postulated that that which could not be reduced to matter did not exist. Descartes, on the other hand, was a dualist; in his eyes, the world consisted either of matter (form or extension) or mind. Mind, as well soul and consciousness, were only possessed by human beings. The only entities besides humans made up of anything other than matter was God and spirits, who were thought to possess soul and consciousness (Gaukroger, 2002). Indeed, mind, which only humanity possesses, is a completely separate element from matter (including the body), containing a completely different set of properties. There is sharp divide between mind and body - no in between or grey zone exists (Gaukroger, 2002). There is also only one kind of matter and one kind of mind. This division affects Descartes' treatment of the two elements. For instance, he attributes teleology, rationality, and consciousness to processes of the mind, but they are absent from the body and all processes of matter.

To Descartes, all matter, whether it was solid, liquid or gas, consisted of only one type of matter (Gaukroger, 2002). This type of matter was homogeneous, inactive and indistinguishable from all other matter. He used this form of materialism as a basis for his physiological as well as celestial mechanism. He argued that mechanism accounted for every physical process in the universe. With his mechanistic materialism, Descartes attempted to account for all behaviour and functioning of animals.

After performing dissections on a variety of animals, Descartes wrote to his mentor, Marin Mersenne, stating that there was nothing he had yet discovered through his experimentations that could not be explained in mechanical terms (Gaukroger, 2002). At the beginning of *L'Homme*, he wrote on animal physiology in which all animal entities are referred to as nothing more than machines. His mechanistic physiology dealt with every internal and external process of the animal – no function nor behaviour could not be accounted for in corporeal-mechanical terms.

To Descartes, animals, nature, and the Earth at large were nothing more than a series of machines. His simplistic mechanism can be summed up in the following passage from *L'Homme:*
"I desire that you consider that all the functions that I have attributed to this machine, such as the digestion of food, the beating of the heart and the arteries, the nourishment and growth of the bodily parts, respiration, waking and sleeping; the reception of light, sounds, odours, smells, heat and other such qualities by the external sense organs; the impression of the ideas of them in the organ of common sense and the imagination, the retention or imprint of these ideas in the memory; the internal movements of the appetites of the passions; and finally the external movements of all the bodily parts that so aptly follow both the actions of objects presented to the senses, and the passions and impressions that are encountered in memory: and in this they imitate as perfectly as is possible the movements of real men. I desire, I say, that you should consider that these functions follow in this machine simply from the disposition of the organs as wholly naturally as the movements of a clock or other automaton follow from the disposition of its counterweight and wheels. To explain these functions, then, it is not necessary to conceive of any vegetative or sensitive soul, or any other principle movement or life, other than its blood and spirits which are agitated by the heat of the fire that burns continuously in its heart, and which is of the same nature as those fires occur in inanimate bodies." (Descartes, circa 1633, part 5)

The principle of animals, as well as vegetative matter, as automaton is perhaps the most popular notion of Cartesian physiology. It is also a foundational part of his natural philosophy.

Descartes was particularly fascinated with the circulatory system of animals. He identified the "animal spirits" in blood as being the most important component of the circulatory system, and thus of his theory of psychophysiology as well (Gaukroger, 2002). He treats plants in the same way, but replaces blood with sap as the medium of transport in circulation.

Cartesian physiology attempts to show how the animal spirits are mechanically carried from the veins in various parts of the body to the pineal gland within the brain (Descartes, circa 1633). The pineal gland is also described as being connected to the nervous system via the animal spirits – the animal spirits induce muscles to move by travelling from the pineal gland, through the hollow tubes of the nervous system to the muscle.

Descartes even worked to describe such processes as imagination, temperament and memory as purely automata in animals. To deal with these more complex phenomena, he used his animal spirits concept (Descartes, circa 1633). So, for instance, animals that displayed caring or affection were described as having a surplus of animal spirits; bravery or self-confidence meant that the animal had strong and rough animal spirits; attentiveness and thoroughness meant that the animal had restless animal spirits; calm meant that animal spirits were uniform; fearfulness meant that the animal spirits were feeble; and cruelty meant that there were very few animal spirits present, etc. (Gaukroger, 2002). He described a variety of other processes, such as sneezing, coughing, breathing, and even dizziness or tiredness using the animal spirits concept. Thus, for Descartes, the entire cognitive process of the animal could be described in mechanical terms. He argued that animals do not have the ability to think, feel and make decisions. Thus, he effectively, erased the notion of agency and autonomous thought in animals.

3.B. Cartesian Mechanistic Physiology: Motivations and Influence

One of Descartes' prime motives was to annihilate teleology from his corporeal natural philosophy (Gaukroger, 2002). There is no purpose in the material Cartesian world – any seemingly unexplainable processes can be explained as functions of chance or necessity. The ultimate and only real cause is God. All other "causation" can be conceived of as purely mechanical.

To prove that sentience was non-existent in matter would be one of the major components of his program (Gaukroger, 2002). He endeavoured to overthrow the commonly held belief at the time that animals had feelings, and certain thoughts that were similar to humans'. Animals were to be reconceptualised as machines completely devoid of these abilities and of any form of language, intellect or selfhood. As he wrote to Mersenne on July 30, 1640, "as for brute animals, we are so used to believing that they have feelings just like ours that it is hard to rid ourselves of this opinion" (AT III.121 – 202 Gaukroger). Descartes was unwavering to the niceties and affections of animals and the cunning they display, later writing:

"I am not disturbed by the astuteness and cunning of dogs or foxes, or all the things which animals do for the sake of food, sex and fear; I maintain that I can easily explain the origin of all these things from the constitution of their organs." (AT V.278).

Hence, Descartes would not budge on his mechanization of animals.

As Gaukroger (2002) highlights, the belief that animals sharing virtue, passion, feelings and other states with humans dates back to the patrological writings of the Church Fathers. The depiction of animals with ideas, sensations and even (in some cases) intellect, is also common in medieval and Renaissance art and literature. Descartes sought to change the course of history.

Cartesian mechanistic physiology knit snuggly into Descartes' objective of rewriting the human-nature narrative. If anything outside of the human mind is mere automata, then man has the moral grounds for exploiting all aspects of the corporeal world. Sentience, the capability of feeling positive and negative sensations, was thought to distinguish animals from plants (Garner, 2003). The fact that animals could feel both pleasure and pain served as moral grounds for humans avoiding the infliction of pain on animals. By eliminating sentience, as well as rationality and intellect, Descartes effectively eliminated the moral obligation that humans have towards these fellow earthlings.

Descartes was fully aware of the concrete advantages of his programme (Singer, 1990). In a letter that he wrote to his friend, Henry Moore, dated February 5, 1649, Descartes writes, "My opinion is not so much cruel to animals as indulgent to men – at least to those who are not given to the superstitions of Pythagoras – since it absolves them from the suspicion of crime when they eat or kill animals." (Singer, 1997, p.201). Indeed, Descartes doctrines about animals and their reaction to stimuli as merely a reflex enabled him to continue the experiments on animals that had helped him formulate his fundamental theories.

Descartes was known for his thoughtless and cruel vivisection of animals, which he conducted routinely in the name of science. One observer at the Jansenist seminary of Port-Royale, an institution created by one of Descartes' disciples and highly influenced by his dualism, wrote:

"They administered beatings to dogs with perfect indifference, and made fun of those who pitied the creatures as if they felt pain. They said that animals were clocks; that the cries they emitted when struck were only the noise of a little spring that had been touched, but that the whole body was without feeling. They nailed the poor animals up on boards by the four paws to vivisect them and see the circulation of the blood which was a great subject of conversation." (Singer, 1997, p.201-202)

So long as a physiologists at the time subscribed to Cartesian dualism and mechanism, they were morally justified in performing such experiments.

Cartesian dualism and mechanism also made it morally justifiable to rape and plunder the natural world. Descartes was explicit in his attitudes towards man and nature. In his *Discours de la Methode* (1637), he states that man must:

"Find a practical philosophy by means which, knowing the force and the action [of natural phenomena], we can ... employ them in all those uses which they are adapted, and thus render ourselves the masters and possessors of nature." (Descartes, 1637, p.35)

Here, he draws from influence that can be traced to the Judeo-Christian tradition. Descartes accepted and endorsed the authority of the Bible, and often tried to reconcile his philosophy with the book of Genesis (Saebo, 2008). In Genesis 1:26, it is stated that God gave dominion of the land to man; nature was regarded as something existing for a human function. In this tradition, man is expected either to appropriate nature for his own purposes, or to be a steward to it. It must be noted, however, that the meaning behind this passage is much disputed, and has been interpreted in a variety of ways by theologists and Christians alike.

Descartes' man-nature dichotomy, and the idea that man is justified in exploiting nature, can also be traced to ancient Greek philosophy. Aristotle argued in *Politics* that "Nature ... has made all animals for the sake of man" (Aristotle, c. 330 BCE). However, Greek tradition also emphasized practicing restraint and avoiding greed and gluttony.

Nevertheless, canons of restraint were more or less turned on their head during the late western Enlightenment. The discovery of the "New World" enabled theorists such as Hobbes, Locke and Francis Bacon to advocate the appropriation of nature without restraint. Although the idea of dominion alone does not necessarily entail ownership, thinkers such as Locke transmuted the idea of dominion to, in fact, be one in the same with ownership and property rights. Locke based his theory of property on the idea that nature held an endless bounty of resources. His wrote his *Two Treatise of Government* at a time when a vast cornucopia of nature was being discovered in the New World. Thus, the endless pursuit of endless desires, fulfilled through material means, was justified.

Descartes appropriated and adjusted values surrounding human dominion over nature, stemming from Judeo-Christianity and Greek philosophy, to fit within his programme and a changing world. Dombrowski (1989) traces the evolution of human-nature relations from Thomas Aquinas (1225-1274) to Descartes, showing the sharp contrast between the two and effectively demonstrating that Descartes' notions of humans and nature were both revolutionary, and foundational to subsequent Enlightenment thought. Aquinas did, however, set a precedent of animal treatment. Aquinas said that God gave the plants and animals to man. Since neither plants nor animals were thought to have reasoning powers, the grounds for exploiting or harming them for human needs was justified, so long as it did not infringe on the property of another person.

However, Descartes popularized the human-nature dichotomy, which shaped Enlightenment thought. Descartes' approach to non-human entities in the Biosphere can be summed up as the idea of *nature as machine*. As previously discussed, by conceptualizing anything outside of the realm of humans to be soulless automata, the value of biota is lowered to that of any lifeless inanimate object. Once this precedence is set, humans are justified in exploiting nature as they so desire.

Descartes programme fit snuggly with Enlightenment thinkers who believed in growth and progress. Francis Bacon, with whom Descartes rubbed

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shoulders, was a great advocate of the fusion of nature and technology in order to gain knowledge and to master the natural world. The objective of Bacon's program was to enable mankind to overcome hardships, to promote economic growth and progress, and to enjoy the good life.

In *The New Atlantis*, published in 1637, Bacon urges his readers to take command of the environment by technological means: "The end of our foundation [for scientific research] is the knowledge of causes and secret motions of things and the enlarging of the bounds of the human empire, to the effecting of all things possible" (Bacon, 1627, Part I). Indeed, Bacon supported a philosophy of science that incorporated Cartesian mechanics and the type of scientific method employed by Galileo. Ophuls (1997) argues that Bacon's investigation, coupled with Cartesian mathematics and Galileo experimentation formed the basis of modern science.

Many key figures in the Enlightenment also drew on Descartes' belief that animals were not part of the moral community. For instance, in his *Lecture on Ethics,* Immanuel Kant (1723-1804) writes, "So far as animals are concerned, we have no distinct duties. Animals are not self-conscious, and are there merely as a means to an end. That end is man," (Kant, 1780, p.240). Thus, a large part of the Enlightenment project was based on the notion that nonhuman biotic life consisted of nothing more than mechanics. This served as the foundation for doctrine that non-human life was unworthy of being part of the moral community. Holding such a conception fit well with the project of human progress and the mastery of the world.

Conclusion

Without a doubt, the motivations behind the Cartesian mechanistic physiology were to enable the growth and progress of the human enterprise.

Descartes drew from the Judeo-Christian tradition of seeking human dominion over the land and the project of progress which gained influence during the Enlightenment period to formulate his natural philosophy. He was a dualist, believing in the reality that all that existed was mind and matter – and mind was something held only by God, and the human mind. All else on the planet was comprised of matter and was therefore, inanimate.

The outcome of the Cartesian mechanistic physiology was a deepening of the division between the human world and the natural realm. Indeed, the animal kingdom, and all other parts of the natural, became nothing more than vehicles to enable the growth and progress of humanity. In chapter 4, we will look at the context of this in light of modern factory farming – and the ways in which the human-nature dichotomy, elevated and popularized by Descartes, have taken on a whole new meaning and set of activities in contemporary society.

Chapter 4

The Birth of Neoclassical Economics based on Newtonian science

"Newtonian or classical theoretical physics, with its conception of the physical universe as a mechanical system, and its theories of the "natural laws" of the motions of bodies and the "working" of that system, profoundly influenced the basic concepts and assumptions commonly involved in eighteenth-century theorizings, not only in the "natural" sciences but also in psychology and economic, political and all social sciences."

- Overton H. Taylor

Introduction

Classical economics, from which neoclassical economics is derived, was founded in the 18th century and based upon the dominant science of the time – Newtonian physics. Economists, being impressed by the current state of science, sought to extract certain laws in physics and mathematics and connect them to the laws of economic actors and their functioning in the market system (Nadeau, 2002).

It is important, before beginning any discussion of Newtonian physics, to delineate precisely what the terminology used refers to. In this chapter, the term "Newtonian physics" will be used interchangeably with "Newtonian science" as well as "Newtonianism" –terms also used interchangeably in the literature. All refer to the same body of science – Newton's physics, specifically that published in his *Principia* (1687, 1713, 1727) (Cohen, 1994).

As Cohen (1994) highlights, there are several issues with the ways in which Newtonian science was transferred to the discipline of economics, as well as the social sciences in general, during the Enlightenment. There existed a profound cross-pollination of ideas, where Newtonianism was extended to other disciplines. Cohen (1994) divides these into four categories where identity is at one end of the spectrum and analogy is at the other end. In between these two categories falls metaphor and homology. Cohen (1994) argues that economists used Newtonian science both in the form of analogy for laws, doctrines, and methods of experimentation, as well as for homologues (or, descriptions of the functioning of things) for the burgeoning economic science. Here, scientific doctrines from the hard discipline of physics to the "softer" science of economics have had profound implications on the birth and evolution of economics from its foremost state of classical economics, on to neoclassical economics today.

Deriving economic (as well as social) laws from Newtonian science continued to be a popular endeavour in the 18th century, and was renewed and transformed in 20th Century economics – the root of our modern day neoclassical market. As Overton H. Taylor (1960) contends:

"Newtonian or classical theoretical physics, with its conception of the physical universe as a mechanical system, and its theories of the "natural laws" of the motions of bodies and the "working" of that system, profoundly influenced the basic concepts and assumptions commonly involved in eighteenth-century theorizings, not only in the "natural" sciences but also in psychology and economic, political and all social sciences." (in Cohen, 1994) (p.71).

In this period of time, Taylor (1960) states that "human, economic and political societies generally came to be conceived or thought of as (either literally or by analogy) 'mechanisms' or 'mechanical' systems, operating or functioning through internal processes conforming to or exemplifying discoverable 'natural' laws i.e. either those of physics (mechanics) or others like them" (p.11).

This chapter will trace an historical trajectory of the ways in which Newtonian science was transferred to the discipline of economics. The chapter will be organized as follows: section A will discuss the basics of Newtonian science, and the ways in which it was transferred to classical economics. It will focus specifically on the metaphysics of deism, ontological dualism, and the French moral philosophers. Section B will examine the influence that Newtonian science had on a key founder of the modern neoclassical paradigm, Adam Smith (1723-1790). Finally, section C will examine the evolution of classical economics to the neoclassical economic paradigm in the 19th century.

4.A. Newtonian Science: Deism, Ontological Dualism, and the French Moral Philosophers

The relevant works of Newton, which were drawn on by 18th century economists and social scientists and which will be referred to in this discussion, are as follows: the first of the three books of *Principia*, where Newton sets out both the laws and definitions of his "rational mechanics;" the third of the three books of *Principia* where his laws of gravity are defined; the experimental natural philosophy in *Opticks* (1704) where he utilizes his rational mechanics; as well as in *Philosophical Transactions* for the Royal Society of London, where he also uses his experimental natural philosophy.

In Newton's concept of empty space in *Principia*, he determined that atoms are the parts in a system and that they are isolated in space and time (Nadeau, 2003); regardless, they move about and interact with one another. Together, these atoms make up the system as a whole. Gravity was considered to be the universal force that lead to equilibrium and order within a system. The guiding force behind gravity and the movement of atoms in this system was considered to be God. God was conceived of as a clockmaker, and the universe as well as its subparts, such as the market, was conceived of as the clock. As the clockmaker, God sets the initial conditions of the system, and from there, the system continues on in the natural order of things.

In other words, God was regarded as an entity that existed outside of the realm of the universe. He was the creator of all that existed in the universe but, after this initial creation, he remained non-interventionalist in its activities. Thus, despite his involvement in setting the initial conditions of the universe, he was considered to be free from responsibility for the activities that were to follow. This notion was known as Deism and had a profound impact on the work of the most influential classical economists: Adam Smith, Thomas Malthus (1766-1834), and David Ricardo (1772-1823).

However, Nadeau (2003) argues that the most significant element of the metaphysical framework of western thought is the notion that the material and immaterial worlds are separate. Ontological dualism, as this notion is referred to, infers a dual framework whereby God, spirits, or consciousness are manifest in a separate realm from the material aspect of worldly things. As Nadeau (2003) highlights:

"Copernicus, Galileo, Kepler, and Newton were inheritors of a cultural tradition in which ontological dualism was a primary article of faith, and they were all convinced that doing physics was a form of communion with the geometrical and mathematical forms resident in the perfect mind of God. This idealization of the mathematical ideal as a source of communion with God provided a metaphysical foundation for the emerging natural sciences. It also served as the metaphysical foundation for a view of the natural laws of economics that Smith would later use to legitimate the existence of the invisible hand." (p. 20)

It was, however, the French natural philosophers that highlighted and elaborated upon the view of ontological dualism. For instance, Charles-Louis de Secondat, baron de Montesquieu, (1689-1755) used it as the basis for the new discipline of sociology, which was founded on the notion that, through observation and experimentation of the material world, complex social phenomena could be derived which represent from the immaterial realm. He even uses the Newtonian notion of equilibrium as a direct homologue for the equilibrium that arrives amongst social forces.

Francois Quesnay (1694-1774), who founded the movement of the Physiocrats in France, utilized this notion as the basis for their various works on the economic system in France as well as the French Revolution (Nadeau, 2003). A main claim of his was that natural laws are what determine surplus value of a good. These natural laws are fabricated by God and operate between individuals who are essentially asocial isolated atoms. Indeed, Quesnay was but only the first among many economic theorists to follow who had an inadequate understanding of Newtonian physics but who, nonetheless, applied this physics to the theoretical underpinnings of economics.

Another French theorist in this camp was Anne-Robert-Jacques (1727-1781) under a framework of ontological dualism; he described the economics of society as something analogous to the way in which blood circulates in the body (Nadeau, 2003). Though Turgot mainly did away with mathematical formalism (unlike his predecessors) he connected the notion of equilibrium, specifically as it relates to the circulation of blood through the vessels in the body, to the general equilibrium reached within an economic system when the systems natural forces are left at play. In one (now infamous) letter to David Hume (1711-1776), Turgot even goes so far as to extract models for various types of employment, production and remuneration that are analogous to the model of equilibrium found in Newtonian physics. Friend and mentor of Turgot, Marquis de Condorcet (1743-1794), had a more comprehensive understanding of Newtonian physics, which he used to create the *mathematique sociale* – which essentially delineated the natural laws that govern human choice and social behaviour (Nadeau, 2003). Condorcet founded the belief that the laws of the social and economic sciences could be grounded in empirical facts. Another one of his major contributions linked to Newtonianism is the idea of the voter acting as an isolated social atom or, *homo suffragons.* This was to become the foundation of the notion of economic actor in the neoclassical market – *homo economicus* (as discussed in chapter 2).

4.B. Adam Smith and Newtonianism

The work of the French moral philosophers served as a foundation, and precursor, to the work that Adam Smith (1723-1790) would produce in moral philosophy and economic theory (Nadeau, 2003). Like the French moral philosophers described in section A, it is important to recognize the metaphysical basis of Smith's theoretical advancements. Like his forefathers, Smith sought to reconcile his Deism with the dominant science of his time – Newtonian physics. The result was a form of reductionism that reduced all worldly things (i.e. things outside of God), to systems, mechanics, and materials. God was conceived of as a clockmaker, and the universe, as the clock. God set the initial conditions, and then withdrew from the situation, enabling the system to function independently henceforth.

Indeed, as Nadeau (2003) notes, the Deism of Smith, and his understanding of the functions of God as the clockmaker and the world as clockwork, enabled his widespread use of metaphors and analogies in his economic and moral writings. His Deism was also foundational to his concept of the natural laws (or, the laws of Newtonian physics) guiding the clock machinations in the natural world, as well as of the natural laws guiding the laws of the market.

In his seminal piece *The Wealth of Nations* (1776), the metaphysics of Deism is prominent. Smith enunciates natural laws in relations to God, and concedes that the purpose of the recognition of the natural laws is to trust in "the natural order of things."

The invisible hand of the market is perhaps the most infamous contribution Smith has made to the discipline of economics. As Nadeau (2003) concedes, the invisible hand is the "ghost in the machine" of virtually all of Smith's writings, though it is only referred to directly in three texts with very different theories (the essays, *The Theory of Moral Sentiments,* and *The Wealth of Nations)* (p.24). As Nadeau states:

"Smith frequently identifies nature with the way things operate on their own accord, and the goal of philosophy, he said, is to "lay open" the "invisible chains which bind together" the natural world. It is, therefore, no accident that the argument for the system of natural liberty in *The Wealth of Nations* is designed to promote trust in the "natural course of things." The trust is warranted, says Smith, because the "hidden chains" of the invisible hand regulate the "system of natural liberty" and constrict the sphere of human "intention and foresight." His argument for the existence of this system is premised on the assumption that "no human wisdom or knowledge could ever be sufficient" to provide the sovereign with the ability to manage effectively the "industry of private people" and direct it "toward the employments most suitable to the interests of society." Given that human beings, both individually and collectively, cannot effectively manage market economies or predict their futures, the only alternative, argues Smith, is for each individual "to pursue his interests in his own way" within "the laws of justice." (p.25 - 26)

Nadeau (2003) goes on to describe that:

"The usual interpretation of Smith's system of natural liberty is that it legitimates the idea that each of us should have the freedom to pursue our livelihood and self-interest in the absence of traditional political, religious, and moral constraints. And because the system requires that the role of the government be limited, it is also widely assumed that Smith makes government the servant of individualism. The problem with these interpretations, which are typically used to support the claim that Smith was a libertarian, is that the system of natural liberty is embedded in larger systems and all these systems obey natural laws." (p.26)

Overall, it was in Smith's opinion that leaving the forces of society to the invisible hand (i.e. enabling natural forces to be unaltered by government or other forms of polity) would best enable the invisible hand to fairly distribute the goods and services within a society. This would ensure the best interests of society (Nadeau, 2003). As Smith (1759) contends, the rich, regardless of that (in his opinion) they tend to be "naturally" more selfish, are:

"...led by the invisible hand to make nearly the same distribution of the necessities of life which would have been made had the earth been divided into equal portions among all its inhabitants; and thus without intending it, without knowing it, advance the best interests of society, and afford means to the multiplication of the species." (IV.1.10).

Moreover, Smith often equated ideas with systems, and stressed the similarities between systems and machines (Nadeau, 2003). In this way, Smith drew a relationship, or even an analogy, between ideas and machines. As Smith writes, a system is "an imaginary machine invented to connect together in the fancy of those different movements and effects which are already in reality performed." (Smith, 1776, Astronomy IV, 19).

His connection of systems with machines and ideas with systems illuminates one of the major dogmatic underpinnings of Smith's work: ideas,

if they come from the human enterprise are something like machines – natural laws are at the forefront of governing the mechanics behind human choice, the machine-work of production and consumption, supply and demand, and exchange to maintain the orderly workings of the economic whole (Nadeau, 2003, p.28).

Hence, Smith's model of the economic actor was that he was guided by the invisible forces or, "invisible chains" present due to natural laws inherent in the system of the universe (Nadeau, 2003). As Nadeau (2003) highlights, this had consequences on his notion of natural liberty: if each atomized economic actor was simply to pursue only his self-interest, a natural order would emerge in the economic system. He rationalizes individualized pursuit of self-interest by arguing that there is no human wisdom or knowledge that could ever match the order produced in a system, as that which emerges through the use of the invisible chains. Smith also defines the order that emerges at both the macro-scale and micro-scale, the former being the market forces of the economic system as a whole, and the latter being the individualized pursuit of utility by atomized economic actors. Nadeau (2003) highlights the outcome of Smith's notions of the macro and micro-levels:

"The basic argument here is that the natural laws act on the parts (atomized individuals) to enhance the welfare of the whole (human population) as a collection of parts, and the freedom of the parts is utterly constrained by these laws. In the "great machine of the universe" with its "secret wheels and springs," the system of natural liberty may allow the atomized individual to live with the illusion that his or her actions are freely taken. But as the wise man knows, this freedom does not, in fact, exist because the "connecting chains" of the invisible hand sustain the whole (economy) in the absence of conscious intervention by parts (economic actors)." (p.29) As Hetherington (1983) concedes, though Smith did not look specifically for causal chains and the laws of nature, he did use a methodology that closely aligned with that used in Newton's *Principia* in his economics. In his "System of the World" Newton uses the following formula: he first presents a description of a phenomenon as it appears to him in observation (for example, observations about the satellites around Jupiter and Saturn). Newton then goes on to describe how these observed phenomena fit into a principle or law. For instance, he shows how the revolution of these satellites around their respective planets fits with the principle of gravity. Thus, Newton derives laws from induction of observed phenomena.

Once Newton sets the law in place by such means (described above), he then shows how all other observed phenomena fit into the law as well. Hence, he uses deduction to describe phenomenological observations and how they fit into principles, once principles have been established by induction. For instance, Newton shows that the law of gravity can be used to describe more than that which is induced (the orbit of satellites around their planets); it can also be used to explain activity of the equinoxes, comet orbits, tidal activity and even the movement of pendulum clocks (Hetherington, 1983).

Indeed, Smith literally plastered elements of Newtonian science onto the burgeoning field of economic science. Hetherington (1983) demonstrates how Smith begins his *Wealth of Nations* in the same way that Newton begins his *Principia:* by first, as objectively as possible describing observed phenomena. Smith examines the division of labour in society in different industrial contexts in order to understand its effects. For example, he describes the way in which a pin in a pin factory is manufactured: by being taken from wiring, drawn, straightened, cut, pointed, ground to fashion its head, and how this method can produce upwards of 48, 000 pins daily. Smith's principle used to explain the phenomena of the fashioning of the pin is the division of labour. He next goes about describing how other phenomena are also explained by the division of labour, thus following Newton's method of induction, principle explication, and deduction. As Hetherington (1983) so aptly describes:

"Having presented the phenomena, Smith next gives the general principle: the division of labor is seen to be the necessary result of a human propensity to exchange one thing for another. Having discovered a natural law or human propensity, Smith then shows how the law encompasses additional phenomena, how the phenomena can be deduced from the principles. Newton showed how gravity explains such phenomena as the motions of comets and the working of pendulum clocks; Smith shows that the propensity to exchange items and the resulting division of labor are present in tribes of hunters and shepherds as well as in the pin factory. (Unlike Newton's unlimited force of gravity, Smith finds the extent of the division of labor limited by the extent of the market.) Similarities in the work of Newton and Smith are apparent even in their answers to the question of the ultimate nature of their discovered general principles. Newton, unable to present a mechanical model to explain the working of gravity, was forced to argue that it was enough for him to show that his law of gravity accounted for the observed phenomena. Unable to determine whether the propensity to exchange one thing for another is an original principle of human nature or a necessary consequence of the faculties of reason and speech, Smith concludes that this question "belongs not to our present subject to enquire." It is enough for Smith that the propensity is common to all men." (p.505)

Interestingly, Smith only refers to Newton's *Principia* in one footnote of the *Wealth of Nations.* In this note, Smith refers to Newton's "Representation to the Lords of the Treasury" where he considers the proportion of gold and silver sold in various countries in Asia (Hetherington, 1983, p.505). Indeed, this is not to say that Smith follows Newton's scientific method at all times in the *Wealth*

of Nations, only to say that there are striking similarities to Newton's method in *Principia* when he does. Indeed, it would come as little surprise that Smith's economics was influenced by the scientific works of Newton (especially given his well-documented admiration of Newtonian astronomy, among other things).

4.C. The Evolution of Classical Economics to Neoclassical Economic Paradigm in the 19th Century

Over the course of the 18th, 19th, and 20th centuries, classical economics branched out and evolved into neoclassical economics, but it still retained many of its foundational elements. As Nadeau (2003) highlights, the neoclassical economics underlying our global environmental crisis today was woven upon a canvas of the same false assumptions that classical economics, neoclassical economics' forefather, rested upon. The metaphysical assumptions of the 18th century were carried on into the 19th and 20th centuries, specifically that of ontological dualism, or the notion that atomized economic actors (parts) move about and exist in a realm of the economic system (whole). The founders of neoclassical economics used 18th century physics, and transformed it into a mathematical formalism that was applied to neoclassical economics.

The metaphysical assumptions of the founding neoclassical economists were used to exchange physical variables for economic variables (Nadeau, 2003). These substitutions created a complex set of layers blanketed by the justification of the use of the invisible hand. The physics utilized was developed between the period of 1840 and 1860 – when physicists were attempting to update Newton's mechanics so that it took into consideration various other forms of energy such as heat, electricity and light. As Nadeau (2003) states:

"The originators of neoclassical economics began with the assumption that a particle or mass point could be viewed as the equivalent of an atomized economic actor that moves along a path in accordance with the principle of least action. Aware that energy in the equations of mid-nineteenth century physics is a force that pervades all space, they concluded that this space could also be filled by a postulated form of energy called utility. None of these figures appears to have seriously considered the fact that utility, assumed to be synonymous with economic satisfaction and well-being, cannot be directly known or measured and is in no way comparable to energy as that term is used in mid-nineteenth century physics. What is equally remarkable, they also dismissed or rationalized away issues of integration and invariance that are critically important to the proper application of the conservation principle. The strategy of the creators of neoclassical economics was as simple as it was absurd – they took the equations from the mid-nineteenth century physics and changed the names of the variables." (p.39)

Ultimately, these economists made a few simple substitutions from Newtonian equations. For example, in terms of energy, potential energy was exchanged for the sum of utility, and kinetic energy was exchanged for expenditures (Nadeau, 2003). What the 19th century economists failed to realize was that utility cannot be conserved in the same way that energy is – the two are incomparable. But, premised on the idea that these assumptions were innate truths, the invisible hand in the market was justified by them as a "law" in economics in the same way that general equilibrium theory was a law in Newtonian physics. Atomized economic actors were said to work within a force field of utility (energy) and the innate laws of economics were the guiding force behind the choices and behaviours of these economic agents. As Nicholas Goergescu-Roegen (1975) highlights:

"It is curious ... that economists have over the last hundred years remained stubbornly attached to one particular idea, the mechanistic epistemology which dominated the orientation of the founders of the Neoclassical School. By their own proud admission, the greatest ambition of these pioneers was to build an economic science after the model of mechanics – in the words of W. Stanley Jevons-as "the mechanics of utility and selfinterest" [48, 23]. Like almost every scholar and philosopher of the first half of the nineteenth century, they were fascinated by the spectacular successes of the science of mechanics in astronomy and accepted Laplace's famous apotheosis of mechanics [53, 4] as the evangel of ultimate scientific knowledge. They thus had some attenuating circumstances, which cannot, however, be invoked by those who came long after the mechanistic dogma had been banished even from physics [23, 69-122; 5]." (p.347)

Conclusion

In essence, neoclassical economics, the paradigm of today's economy, was based on a faulty transfer of science. Newtonian science is not analogous to the "science" of economics: laws of physics cannot be easily transferred from a discipline in the hard sciences to one in the social sciences. Yet, in the spirit of being rigorous and methodical, this is precisely what economists at the time sought to do. In addition to deriving physics equations to better understand the realm of human behaviour and market activities, they also used Newtonian's scientific method to come to their economic principles.

The main issue with the mechanistic dogmatic foundations of neoclassical economics is that it justifies the unregulated behaviour of economic actors in the market. In other words, it reinforces the idea that economic actors or, consumers and producers, may act however they wish in order to best maximize their own personal utility. Under the ethical veil of utilitarianism, the idea is that the greatest good for the number will be met, so long as each actor continues to maximize his own utility.

The foundations upon which our classical market was based upon – classical economics – still holds today. In return, we are left with an economic system of disharmony, based on equations, "laws" and dogmatic beliefs that reflect little reality about the functioning of the market and economic agents. In the context of factory farming, the system reinforces the thoughtless consumption of meat and animal products in order to maximize personal utility. This is justified in the market, as the "laws" of neoclassical economics dictate that so long as each economic agent maximizes his own utility, the market will reach equilibrium, and the best outcomes for society will result. The problem, however, is that unrestrained consumption of meat and animal products has resulted in a massive expansion of the animal agriculture industry, irrespective of issues of animal welfare and biophysical limits. The implications of our neoclassical economic system will be discussed in more detail in chapter 5 (focussing on animal welfare issues surrounding factory farming) and in chapter 6 (focussing on the ecological issues associated with livestock agriculture in general).

Chapter 5

Case Study of a Modern Implication of Enlightenment Philosophies: Factory Farming

"What is it that should trace the insuperable line? ... The question is not, Can they reason? nor, Can they talk? but, Can they suffer?" - Jeremy Bentham

Introduction

Modern farming practices serve as a very cogent and riveting example of the Hobbesian and Cartesian ethic in practice, and as an activity that knits in very well with the neoclassical regime. Let us begin with a brief overview of factory farming (also known as confined animal feeding operations (CAFOs) or "intensive livestock production". Factory farming can be defined as "the keeping of certain livestock (e.g. beef, pigs, poultry, etc.) mainly indoors, often in relatively large numbers, with the aim of maximizing efficiency by reducing per capita costs (e.g. labour, equipment, feed, etc.) and the area required" (Ibrahim, 2007).

Food systems and the manners and operations involved in transforming a living animal to the meat remains a mystery for many consumers today (Singer, 1997). Consumers often rely on the blind hope that the animals in which they serve at the dinner table were raised on idyllic farms reminiscent of the old English countryside.

But animal husbandry changed drastically over the course of the 20th century. Factory farms are designed to maximize profits at the expense of animal welfare, social welfare, and environmental and human health. For the purposes of this chapter and due to page limit constraints, only a discussion of animal welfare will ensue.

Chapter 5 will be organized in the following manner: section A will provide a brief history and overview of factory farming and the issues it is associated with, focused on the animal welfare issues; section B will connect Hobbesian materialism and the state of nature (chapter 2) to factory farming, paying particularly close attention to the ways in which the individual is framed in the state of nature, and the way this has played itself out in market actor behavior; section C will relate the Cartesian mechanistic physiology (chapter 3), with specific regards to the human-nature dichotomy (an outcome of the nature-as-automata principle) and the tangible manifestation of such in factory farming; section D will describe the role that neoclassical economics plays in reinforcing the factory farming industry and reproducing its activities and structures (chapter 4).

5.A. Factory Farming: A Brief History and Overview

Animal agriculture transformed into factory farming in the 1920s in North America, when the discovery of vitamins A and D enabled farmers to lower expenses by crowding animals together in dark barns, no longer requiring pasture for sunlight and exercise (In Defense of Animals, 2009). Productivity was increased and costs were decreased through the use of fordist, assembly line production methods; the mechanization of the raising, tending to, and slaughtering of animals; and economies of scale, among other things. Over the past 50 years, factory farming has become normalized – it is the primary method of meat production in North America.

Today, roughly 9.5 billion animals are slaughtered annually in the United States alone (Ibrahim, 2007). According to the U.S. Department of Agriculture (2005), animal slaughter in 2003 comprised of 8.5 billion broiler chickens, 274 million turkeys, 100.9 million pigs, 36.5 million cattle and calves, and 3 million sheep and lambs. The majority of these animals live confined in factories in crowded, dark, unsanitary conditions for the duration of their lives. They are not gifted with the pleasures of life that others take for granted: the ability to move freely about one's home, the ability to go outside and enjoy the sunshine and other elements, the ability to pick food, the ability to nestle with others, and the abilities to frolic, play and procreate. These animals are more or less immobilized by confinement, and unable to enjoy the simple delights of life. Most never even interact with humans before they are slaughtered.

Animals are treated as no more than machines in the factory farming industry (In Defense of Animals, 2009). Broiler chickens are bred selectively in order to produce the largest and meatiest poultry. They are also injected with grow hormones that cause their breasts and feet to swell to unnatural sizes. This enables farm owners to "grow" more meat per chicken and to increase profits (chicken breasts and chicken feet being the most highly sought parts of the bird). Selective breeding and systematic hormone injections, combined with a diet unnaturally high in protein and fat causes the chickens to grow to the extreme point where they often break their own bones due to the weight of their bodies. With this triad approach, the rate at which the average broiler chicken grows is bewildering – an estimated 3.5 pounds of marketable meat per chicken is produced in the span of only seven weeks.

Farm owners aim to reduce all costs associated with the upbringing of their chickens. To reduce feeding costs and increase meat fat content, chickens are raised in overcrowded houses or cages where they can barely move, let alone exercise (In Defense of Animals, 2009). But overcrowded conditions induce chickens to fight with one another by pecking and kicking. To reduce veterinary costs associated with chicken fights, farmers slice off the chickens' beaks as well as the ends of their toes.

Life for the egg-producing chickens (known as layer chickens) is equally as dismal as that of the broilers. In the United States, approximately 250

62

million hens produce 95 per cent of commercially sold eggs (In Defense of Animals, 2009). Like broilers, layers are reduced to a life of confinement farmers will pack up to eight birds in a cage of only 12 to 14 square inches, and cages are stacked on top of one another. Birds' beaks are also seared off early in life to reduce costs due to fighting injuries. Male chicks born into these enterprises are separated and thrown into the garbage as waste, where they either suffocate or die of injuries. Hens are forced to continually lay eggs after each cycle through forced molting (incurred by starvation and water deprivation). It is common for these hens to die due to stress, exhaustion and lack of nutrition and minerals due to an unnatural life of constant egg laying. At the end of their miserable lives, layer hens must endure the slaughterhouse just as broilers do.

Every aspect of the pig's life is mechanized: from watering and feeding, to lighting, climate and waste removal (In Defense of Animals, 2009). Improper sanitation and waste removal cause a proliferation of toxic gases, and bacteria and viruses in the factories. The unsanitary conditions of the pig factory create environments that enable diseases such as cholera, pneumonia, dysentery and trichinosis to thrive. Sows are tethered to their cages, and piglets are removed from their mothers and fed via mechanized milk dispensers within days of being born. Pigs are notoriously intelligent and social creatures, and share many character traits with human beings. The conditions of factory farms cause physical and mental stress on the animals, and many go insane. Their insanity manifests in a variety of ways, such as in tedious and repetitive movements and noises, or even cannibalism.

In terms of cattle, veal calves are separated from their mothers just days after birth and confined to a tiny, dark crate for the duration of their lives (In Defense of Animals, 2009). Some calves are even tethered to the ground so that they cannot stand up. These activities are undertaken to prevent muscle growth, thereby ensuring that the meat of the veal calve remains tender and more profitable. Veal calves are also fed diets that are low in nutrients such as iron – which causes them to go anemic and makes their meat lighter in colour (a more appealing colour and a better sell to consumers). Hence, the life of the veal calf is one of poor nutrition, no light, no companionship and no movement.

Every aspect of the dairy cow's life is centred on maximizing its milk production. Their lives take place within the confines of the factory walls. Like pigs, they are fed, watered and their habitats sanitized by mechanized systems (In Defense of Animals, 2009). In the United States, the majority of dairy cattle are injected with Bovine Growth Hormone causing their udders to expand and their bodies to produce 20 percent more milk than produced naturally. Dairy cows live in a continuous cycle of impregnation, separation from their calves, and milk production. Male calves born from dairy cows are sent to the veal crates; all females born must endure a life of intensive confinement and endless milk production. When a cow can no longer produce milk, she is sent to the slaughterhouse.

The journey of pain and suffering continues when animals from CAFOs are transported to the slaughterhouse. The trip from the factory to the abattoir can be as long as several days. Animals are offered neither food nor water on this trip, and their premises are not sanitized (In Defense of Animals, 2009). They also suffer in overcrowded crates and must weather whatever climatic elements arise on their journey. Once they reach the abattoir, they are stunned through electrocution, de-feathered or de-furred in boiling water, and slaughtered in a mechanized factory line. Unfortunately, the machinery used for these processes is often inaccurate, leaving the animals to needlessly suffer for extended durations of time.

5.B. Factory Farming and Hobbesian Materialism and State of Nature

In the discussion of Hobbes, a direct link is drawn between his idea of man in his natural state, and the way is which man today is expected and even encouraged to act in the market. The Hobbesian state of nature became a selffulfilling prophecy. In the market and in dominant institutions, individuals are expected to act in a way that privileges the individual over the collective, personal gratification over giving, and insatiability over satiability. In the Hobbesian framework, it is perfectly rational for consumers to pursue selfgratification through market mechanisms. In the context of the animal products, it is perfectly rational and in fact, even economically favourable, for people to continue purchasing meat from animals. The animal welfare implications behind the "production" of animal products do not come into play at all in discussions of the market, rationality, or utility. Utility in the market is only calculated in anthropocentric terms.

Indeed, all that matters to the Hobbesian man in his natural state is his personal utility. If purchasing and consuming factory farmed meat satisfies the consumer and enables self-preservation, he is not only perfectly justified in doing so, he is considered to be enabling the perfection of the market mechanism.

Hence, the connection between Hobbes' state of nature, translated into *homo economicus* today, to modern factory farming operations is strong. In the context of factory farming, one can draw a direct link between *homo* *economicus* and the treatment of animals. Within a neoclassical economic framework, it is perfectly justified to treat non-humans for human ends.

As discussed, even individual men and women, when living in a state devoid of polity, are pitted against one another. Human life in its natural state is a state of war. It is the function of polity and laws to ensure that the passions of humans are reigned in, and to force them to act in a civil manner. With regards to factory farming - there are few laws in place and nearly no enforcement to ensure that animals are treated in a way that reduces their pain and suffering (Ibrahim, 2007). Hobbes would consider, then, the way in which these farm animals are treated to be perfectly natural for humans; after all, man is acting in accordance with his self-interest, and the operations are legal and enable the preservation and satisfaction of the individual. As well, classical economists such as Smith and Ricardo would also consider these practices to be natural for they aid in the maintenance of market equilibrium (an inherent good, since the market is theoretically in the service of the people and increasing the utility of communities). Hence, again, we see another way in which Hobbesian philosophy and economics reinforces and justifies the treatment of animals in factory farms.

The natural man is isolated from his environment. All that exists outside of his entity is corporeal substance. Everything else, whether it is pigs, chickens and cattle living within the factory, or the factory itself (with its mechanized lighting, automated feed machines and cages) is mere matter. If all entities and substances outside of the human self are mere matter, then all things fall onto the same moral plane, outside of (and below) the moral community of humans. In this way, it is justifiable to appropriate even animals for human ends. The segregation of animals in industrial factories that are separate from urban and residential life, is symbolic of the human-nature dichotomy.

An interesting phenomenon today occurs in law, whereby corporations are treated as individuals in the legal realm, but farm animals are treated as property (Ibrahim, 2007). The idea of property was popularized by Locke, who, as discussed, was influenced by Hobbesian political economy. Locke contended that God had granted dominion of all non-humans to man – this meant that man had moral justification for treating animals as property (Locke, 1690). However, Locke did concede that humans were rational creatures, and this rationality would, theoretically, reign in humanity's lust for accumulation and moderate it. Regardless, as discussed, property was one of the rights of man, and so it follows that man has the natural right to utilize animal property in the same way as he does other forms of property.

Any discussion of Locke's theory of property deserves to include also an acknowledgement of Locke's views on cruelty towards animals, which he opposed. In Some Thoughts Concerning Education (1693) he argues that animals (in contrast to Descartes) in fact do possess sentience, and that putting them through pain or suffering was morally unjustified. However, his ultimate reasons for such appear to be anthropocentric - animals were not to be harmed by people because this may encourage the justification of the harming of other people. As Locke (1693) wrote (in the context of the torture of animals by children), "For the custom of tormenting and killing of beasts will, by degrees, harden their minds even towards men." (p.91)

In any case, today, any rights granted to other animals are subsumed by the rights of the corporate agribusiness in the case of factory farming. This law effectively permits cruelty to animals by corporations. As Ibrahim (2007, p.93) states, "Corporate personhood and animal thinghood allow for the corporate ownership of animals." The moral hierarchy in modern society is clear: on the top of the heap are human individuals *and* corporations; animals and biotic entities are only considered secondarily. This alludes to the domination that the market holds over other realms of society, such as the social, spiritual and political.

More than 98 percent of domestic animals are "owned" by corporations in the United States (Ibrahim, 2007). In recent decades, corporate control has subsumed agriculture, leading to the demise of the family farm. Small farms have been bought out by large corporate agribusinesses. Vertical integration has enabled corporations to command every aspect of the food production system. In the 19th and early 20th centuries, for instance, chicken farming was mainly family-sufficient – households would raise no more than 25 chickens, and consume the majority of the birds and eggs. Chicken farming today has transformed into a multitude of chicken CAFOs, comprised of every part of the process (including hatcheries, broiler factories, layer factories and feed mills). These CAFOs are owned and operated by a handful of corporate giants.

5.C. Factory Farming and Cartesian Mechanistic Physiology

In the food industry, rather than being considered as animals with sentience like humans, animals are treated as machines. Ibrahim (2007) makes the claim that, although the Cartesian doctrine of animals as automata is generally rejected, factory farms can only exist if Cartesian principles are practiced. Further, because the majority of North Americans consume factory farmed meat (more than an estimated 98 percent) it can be argued that the continent still embraces Cartesian principles (though perhaps more so in praxis than theory). The economic logic of factory farms rests in their advantageousness to corporations and consumers. The corporation can increase production and profits; the consumer enjoys the benefits of purchasing meat at the lowest possible cost. Ibrahim (2007) notes that there is a chasm between our normative principles of how animals should be treated, and how they are actually treated. In factory farms, "animals are treated like machines that convert low-priced fodder into high-value flesh, and any innovation will be used if it results in a cheaper 'conversion ratio'" (Singer, 1997, p.97). Ibrahim (2007, p.100) highlights how the "Cartesian promise" is fulfilled by modern agribusiness (2007, p.100). Descartes' program of utilizing animals for human means, regardless of the pain and suffering it may cause, is still alive and well today.

In fact, the fate and suffering of the CAFO animal paired with the pleasure and utility that the result (meat) gives to citizens, could be considered a direct manifestation of the project of progress, a main initiative during the Enlightenment. Descartes was a prime advocate of this. Enabling people to consume what they wish, to derive nutrition from animal protein without the need to toil in the farm by day, and with the ability to pursue other forms of knowledge and material gain for the human enterprise, knits into the project of progress which was front and centre to the rationalization of Descartes' natural philosophy and metaphysics. As Bury (1920) notes, "Cartesianism was equivalent to a Declaration of the Independence of Man... He looked forward to an advancement of knowledge in the future, on the basis of his own method and own discoveries, and he conceived that this intellectual advance would have far-reaching effects on the condition of mankind. The first title he had proposed to give to his *Discourse on Method* was 'The Project of Universal Science with can elevate our Nature to its highest degree of Perfection. He

regarded moral and material improvement as depending on philosophy and science." (p.65-67) Unfortunately, moral and material improvements were not factored in for the realm of non-human animals. The notion of "progress" or "improvement" only related to the progress and improvement of the human enterprise.

So it follows that every action performed on CAFO animals by humans is directly related to a function serving human utility. Today, this translates into economic ends. Growth hormones, high calorie diets and lack of exercise make each animal larger and more profitable (Ibrahim, 2007). The severing of parts that animals may fight with, the crowded conditions, the automated food and water dispensers and waste removal, and the lack of medical care all reduce overhead costs. Veterinary care on CAFOs is rare, as it is often more economical to allow animals to die rather than to treat them for illnesses or injuries. As one factory farm owner states, "We don't get paid for producing animals with good posture around here. We get paid by the pound!" (Ibrahim, 2007, p.102). It is considered a "waste" rather than a pity, when animals kill one another due to overcrowding. As one farm hand states, "It's a damn shame when they kill each other. It means we wasted all the feed that went into the damn thing" (Ibrahim, 2007, p.102). This alludes to the Cartesian principle of animals as automata, and as functioning for the sole purpose of the service of man.

Conceptualizing animals as automata reinforced and enabled the use of animals as part of the Independence of Man. More cogent examples of the nature as machine doctrine in practice, is in the slaughter of the animals. As Ibrahim (2007, p.104) reveals:

"Many of the animals are stunned improperly, as proper training and use of electronic stunning equipment requires a skill and care incompatible with the cost-cutting objectives of mass production. Yet the large number of animals that must be slaughtered each day means that the production line is not stopped because an animal is improperly stunned, and firsthand accounts from slaughterhouse workers reveal that animals are often scalded or skinned while still conscious. According to one slaughterhouse worker who cuts the hooves off cattle: 'They blink. They make noises. The head moves, the eyes are open and still looking around. They die piece by piece.' (Eisnitz, 1997, p.62) A hog-slaughterhouse worker offers a similar observation: 'By the time they hit the scalding tank, they're still fully conscious and squealing. Happens all the time' (Eisnitz, 1997, p.62)."

Another quote from an American hog farmer makes explicit reference to animals as machines: "Forget the pig is an animal. Treat him just like a machine in a factory. Schedule treatments like you would lubrication. Breeding season is like the first step in an assembly line. And marketing like the delivery of finished goods," (Bynres (1976) in Ibrahim (2007). These accounts serve as evidence of the Cartesian doctrine at practice today. Under Cartesian mechanism, it is perfectly justifiable for corporations to use animals to increase profits.

The neoclassical economic system induces agribusinesses to use Cartesian principles on animals to increase efficiency (Ibrahim, 2007). Theorists on ethics today are beginning to note the influence of Cartesian principles on modern agribusiness in general. As Pollan (2002) highlights:

"To visit a factory farm is to enter a world that, for its technological sophistication, is still designed according to Cartesian principles: animals are machines incapable of feeling pain. Since no thinking person can possibly believe this anymore, industrial animal agriculture depends on a suspension of disbelief on the part of the people who operate it and a willingness to avert your eyes on the part of everyone else." (p. 58 in Ibrahim (2007))

Some agribusinesses have attempted to move towards corporate social responsible farming by incorporating considerations of animal welfare and ethics into their practices. Unfortunately, ethical practices such as increasing the habitat size for animals can often result in heightened production and overhead costs that may push these producers out of the market (Ibrahim, 2007).

However, in recent decades, consumers have become increasingly willing to pay a premium for animals that have been raised in more ethical conditions. The hitch is that corporations may often market their meat as being ethically produced, when, in reality, the improvements made to individual animal lives are miniscule. As is typical of practices and trends in the market, corporate social responsibility often turns into more of a marketing scheme to attract niche consumers rather than a marked improvement in animal welfare.

5. D. Factory Farming and Neoclassical Economics

Factory farming exists, in part, due to the nature of the neoclassical market. As touched upon in section B and C, the modern day factory farm fits in perfectly with the neoclassical market, and under this system, factory farming is economically logical. By reducing costs and maximizing the growth of animals through means discussed above, CAFO corporations are able to maximize their profits and fulfill their bottom-line objective. The industry has become increasingly "efficient" in terms of requiring minimum resources and delivering maximum output. Animals are treated as just another component of the factory farming machine.
Throughout the past decades, smaller-scale animal farming enterprises have been bought out by larger ones, thereby creating an oligopoly in the industry. Horizontal integration has swept across agribusiness (Ibrahim, 2007). Agribusinesses have consolidated the market by buying out their smaller competitors, often in tandem with vertical integration. Corporations such as Tyson have engaged in both horizontal and vertical integration – horizontal in that they have bought out other organizations in their industries; vertical in that they have also gained control of all levels and processes of animal agriculture – from the breeding, raising and upbringing, to the slaughter and packaging of these animals into commodities in the supermarket.

In the neoclassical market tradition, market equilibrium is not reached until producer supply and consumer demand meet. Many advocates of the meat and animal product industry claim that it is reactive – that it only produces based on consumer demand, and that it functions to feed and sustain a growing human population with increasing affluence. However, the reality is that humans in the developed nations where meat consumption per capita is the highest, are consuming more animal protein than is required by the human body. Yet the industry continues to expand, and humans continue to consume larger quantities per capita of meat. In 2006, Americans ate more meat per capita than ever before, at 233.9 pounds annually per person (American Meat Institute, 2009).Even the developing nations where affluence is rising are demanding more meat in the diets (such as is the case in China).

The unifying element is that all countries in the world now function under is the neoclassical market regime. The main motive of a company or enterprise within this regime is the profit motive – all other considerations are secondary in priority. Therefore, the animal suffering and the ecological destruction caused by these industries is of less importance (or of no importance) than the generation of wealth. This is the torment of the system. The bottom line rules all, and the meat and animal product industry has proven to be successful at generating a higher profit margin than more archaic methods.

All of these factors relate back to the way in which the classical market was founded on principles of Newtonian physics, and followed the framework of 18th century mathematics. Utility cannot be treated as a substitute for energy, and more importantly, humans are not isolated social atoms, existing in a void of natural laws, and holding of perfect information of the market and of perfect rationality. But the assumption underlying industries today, including the meat industry, is just that. Under this regime, human citizens are considered to be consumers. As such, they are expected to hold insatiable consumer needs, to be materialistic and hedonistic. Therefore, the increasing demand for meat and animal products is a natural outcome of homo economicus in the market.

Conclusion

The Newtonian tradition from which our economic system sprang, laid the principles and a framework that were highly conducive to the transformation of animal farming from animal husbandry (which emphasizes the raising of animals in traditional pasture settings) to factory farming. Any industry functioning under modern economic principles must be as efficient as possible in order to create the highest return for the lowest possible inputs. CAFOs are a perfect example of a system that is efficient in the production of meat and animal products.

Descartes' natural philosophy has also been profoundly influential on modern activities. If nature is nothing more than a series of inanimate objects, or, automata, then it does not deserve to be a part of the moral community of humans. This is the basic premise behind the argument for transforming nature into human goods. Farm animals have been modified and commodified through captive raising, selective breeding and domestication, injection of growth hormones and other substances, and confinement within intensive agricultural systems. Factory farming is a tangible example of Cartesian principles in practice today – there is no other justification for treating animals this way (Ibrahim, 2007).

Hobbes' *Leviathan* was a key piece in Enlightenment thought and the political economic theory that arose from it. His state of nature transformed into a self-fulfilling prophecy (Ophuls, 1997). Today, the characteristics that are most valued are those related to individual success, wealth and fame. Individuals are encouraged to be pitted against one another in a dog-eat-dog type world. Moreover, generations since the Enlightenment have been lead to believe that, like Hobbes' argued, we are each isolated social atoms – distinct and separate entities from our environment. The implications of this human narrative have been profound and far-reaching. For one, they have influenced human characteristics similar to that of the pathological narcissist (Glass, 1980). Further, when humans regard themselves each as individuals encapsulated and isolated in bags of skin, anything outside of them is distinct and separate, including the realm of nature. This notion, coupled with Hobbesian materialism, has helped justify humanity's conquest over nature. Factory farming is a tangible outcome.

Chapter 6

Ecological Implications of Animal Agriculture

"While we ourselves are the living graves of murdered beasts, how can we expect any ideal conditions on this earth?"

- George Bernard Shaw

"Those who claim to care about the well-being ... and preservation of our environment should become vegetarians for that reason alone. They would thereby ... reduce pollution, save water and energy, and cease contributing to the clearing of forests." - Peter Singer

Introduction

Animal agriculture impacts and changes nearly every sector of the global environmental system. In 2006, the United Nations Food and Agriculture Organization (UNFAO) released the "Livestock's Long Shadow: Environmental Issues and Options." Changes occurring to ecosystems ensue both directly and indirectly due to animal agriculture. Indirect changes include biodiversity loss and climate change due to the direct change of deforestation for feed crops and other agricultural land. Direct impacts include the pollution of available water resources, the eutrophication of water bodies, and soil and land degradation.

For the purposes of this section, the implications of factory farming have been amalgamated with those of livestock agriculture in general, since the best information on ecological implications is most plentiful for the latter. "Livestock" here will refer to all the animals previously discussed in chapter 5, those raised for the purposes of both meat and animal products (including poultry, cattle, pigs, and sheep).

Since the Enlightenment, nearly 75 percent of the world's ice-free land cover has been converted for human, mostly agricultural, use (Ellis & Ramankutty, 2008). Today, 35 percent of the world's land cover is still visibly used for agriculture. An international assessment showed that 23 percent of the earth's agricultural land is now degraded, 3.4 percent of which has become completely degradation beyond use (UNEP GEO 2002, p.64). Figure 1 illustrates the change of land use from the advent of the Enlightenment period (1700) to today.



Figure 1 Changes in Land Use from 1700 to 2000

Figure 26: Projected land use changes, 1700–2050. (Source: IMAGE).

Source: UNEP, 2009, p. 70

Agricultural change made to land has been a leading cause of decline in global biodiversity. Researchers state that we are entering the sixth historic period of a great extinction; biodiversity is declining at a rate of not less than 1000 times the background rate (UNEP GEO-4, p.164).

This chapter will be organized as follows: section A will document land use changes and land degradation that is a direct result of livestock agriculture; section B will discuss water withdrawals and wastewater issues associated with livestock agriculture; section C will discuss the indirect effect of biodiversity loss due to livestock agriculture; section D will briefly discuss the issue of climate change and increases in anthropogenic greenhouse gases as it relates to livestock agriculture. Due to space constraints, sections A, C, and D will only give brief overviews of the ecological implications associated. More depth will be given to section B on the implications on water and wastewater.

6.A. Land Use Change and Land Degradation

Land devoted to livestock production has expanded rapidly since the Industrial Revolution. But between 1950 and 1980, more land was converted into crops than in the past 150 years (MEA, 2005a). The expansion of land devoted to the production of livestock is a major contributor to deforestation worldwide, most notably in South America where deforestation is the most rapid (UNFAO, 2006). Here, 70 percent of land once rich in forest ecosystems has now been converted to pastureland and feed crops. Today, land devoted to the livestock sector represents 30 percent of land use cover at 3.9 billion hectares. Of these 3.9 billion hectares, 0.5 are intensively farmed feed crops, 1.4 are intensive pastureland and 2.0 re extensively managed pastureland. The livestock sector takes up 78 percent of all agricultural land and 33 percent of cropland (UNFAO, 2006). As the demand for livestock commodities grows, so does the expansion of land devoted to livestock agriculture (including feed crops). Table 1 details the regional trends in land use for arable land, pasture and forest between 1961 and 2001.

Table 1 Regional trends in land use for arable land, pasture and forest from 1961 to 2001

		Arable l	and		Pasture		Forest	Forest	
	Annual growth rate (%)		nnual vth rate (%) land in		Annual growth rate (%)		Annual growth rate (%)		Share of total land in
	1961- 1991	1991- 2001	2001 (%)	1961– 1991	1991- 2001	2001 (%)	1961– 1991	1990- 2000 ²	2002 ² (%)
Developing Asia ¹	0.4	0.5	17.8	0.8	0.1	25.4	-0.3	-0.1	20.5
Oceania	1.3	0.8	6.2	-0.1	-0.3	49.4	0.0	-0.1	24.5
Baltic states and CIS	-0.2	-0.8	9.4	0.3	0.1	15.0	n.d.	0.0	38.3
Eastern Europe	-0.3	-0.4	37.7	0.1	-0.5	17.1	0.2	0.1	30.7
Western Europe	-0.4	-0.4	21.0	-0.5	-0.2	16.6	0.4	0.4	36.0
North Africa	0.4	0.3	4.1	0.0	0.2	12.3	0.6	1.7	1.8
Sub-Saharan Africa	0.6	0.9	6.7	0.0	-0.1	34.7	-0.1	-0.5	27.0
North America	0.1	-0.5	11.8	-0.3	-0.2	13.3	0.0	0.0	32.6
Latin America and the Caribbean	1.1	0.9	7.4	0.6	0.3	30.5	-0.1	-0.3	47.0
Developed countries	0.0	-0.5	11.2	-0.1	0.1	21.8	0.1	n.d.	n.d.
Developing countries	0.5	0.6	10.4	0.5	0.3	30.1	-0.1	n.d.	n.d.
World	0.3	0.1	10.8	0.3	0.2	26.6	0.0	-0.1	30.5

Regional trends in land use for arable land, pasture and forest from 1961 to 2001

¹ Data on pasture excludes Saudi Arabia.

² Data for 2000 obtained from FAO, 2005e.

Note: n.d. - no data.

Source: FAO (2005e; 2006b).

But while the global demand for meat and animal products increases, so too does the intensity of farming methods. This strategy has enabled farm managers to maximize profits without necessarily investing in more land. Figure 2 illuminates global trends in land-use area for livestock production and total production of meat and milk.

As the UNFAO (2006) highlights, conversion of once natural landscapes into land for livestock agriculture is associated with a large number of negative externalities including loss of habitat, biodiversity loss, and deforestation. Moreover, the changes induced by the expansion of agriculture are set to increase in ecological footprint due to continual soil erosion, land use degradation and water pollution caused by the activity. Positive feedback cycles are often reached, which leads to increasing amounts of deterioration and destruction.



Figure 2 Global Tends in Land-Use Area for Livestock Production and Total Production of Meat and Milk

Source: FAO (2006b).

Source: UNFAO, 2006

6.B. Water Withdrawals and Wastewater

Globally, agriculture constitutes the number one use of water (UNFAO, 2006). The majority of these withdrawals are for maintaining crops for feeding livestock through irrigation. Two other main reasons for withdrawing water for agriculture are for the drinking water of livestock and for the servicing of livestock facilities. However, the increasing use of water related to livestock

agriculture also corresponds with an era of increasing water scarcity. Per capita levels of available potable water for human use and consumption are declining.

For the purposes of this section, definitions of "water use" or "water withdrawals," "water demand" and "water depletion" or "water consumption" will be taken from the UNFAO (2006) Livestock Long Shadow Report. As the report defines:

"Water use" (also referred as "water withdrawals" in the literature) refers to the water removed from a source and used for human needs, some of which may be returned to the original source and reused downstream with changes in water quantity and quality. The "water demand", refers to a potential water use (adapted from Gleick, 2000). "Water depletion" (also referred as "water consumption" in the literature) refers to the use or removal of water from a water basin that renders it unavailable for other uses. It includes four generic processes: evapo-transpiration; flows to sinks; pollution; and incorporation within agricultural or industrial products (adapted from Roost et al., 2003, Gleick, 2000)." (p.128)

Agriculture constitutes the largest global human water use at roughly 70 per cent of all water withdrawals, and 93 per cent of water depletion (table 2) (Turner et al., 2004). The rate of water use withdrawn for irrigation has expanded by five times since the beginning of the 20th century. The amount of water withdrawn for feed crops is also significant. The four major feed crops globally are barley, wheat, maize, and rice (UNFAO, 2006). Together, these four feed crops are estimated to have roughly 15 per cent of the water used for irrigation evapotranspirated (which contributes to the depletion of already-scarce water resources).

Table 2 Water use and depletion by sector

futer use and depiction by sector								
Sector	Water use	Water depletion						
	(Percenta	ages of total)						
Agriculture	70	93						
Domestic	10	3						
Industrial	20	4						

Water use and depletion by sector

Source: Brown (2002); FAO-AQUASTAT (2004).

Source: UNFAO, 2006

Large amounts of potable water are withdrawn for livestock facilities. The main reason is for providing the animals with drinking water, hence, the water drawn must be potable. Water constitutes 60 to 70 per cent of an animals' body mass (UNFAO, 2006). The higher the temperature and the drier the region, as well as the larger the animal, the more drinking water is required by the animals. Table 3 and 4 illustrate the drinking water requirements for various livestock species.

When livestock are not given their required volumes of water for drinking, they are not able to produce optimal amounts of meat and other products. To maximize profits, livestock facility managers must ensure that animals are offered the drinking water required for their species, body mass, as well as based on the temperature and climate (humidity) of the region.

Table 3 Water use for drinking-water requirements

Regions	Total yearly water intake (km³)						
	Cattle	Buffaloes	Goats	Sheep	Pigs	Poultry (100)	Total
North America	1.077	0.000	0.002	0.006	0.127	0.136	1.350
Latin America	3.524	0.014	0.037	0.077	0.124	0.184	3.960
Western Europe	0.903	0.002	0.013	0.087	0.174	0.055	1.230
Eastern Europe	0.182	0.000	0.003	0.028	0.055	0.013	0.280
Commonwealth of Independent States	0.589	0.003	0.009	0.036	0.040	0.029	0.710
West Asia and North Africa	0.732	0.073	0.140	0.365	0.000	0.118	1.430
Sub-Saharan Africa	1.760	0.000	0.251	0.281	0.035	0.104	2.430
South Asia	1.836	1.165	0.279	0.102	0.017	0.096	3.490
East and Southeast Asia	0.404	0.106	0.037	0.023	0.112	0.180	0.860
Oceania	0.390	0.000	0.001	0.107	0.010	0.009	0.520
Total	11.400	1.360	0.770	1.110	0.690	0.930	16.260

Water use for drinking-water requirements

Sources: FAO (2006b); Luke(2003); National Research Council (1985; 1987; 1994; 1998; 2000a); Pallas (1986); Ranjhan (1998).

Source: UNFAO, 2006

Table 4 Service water requirements for different livestock types

		Service <i>(litres/ani</i>	water m <i>al/day</i> /	
Animal	Age group	Industrial	Grazing	
Beef cattle	Young calves Adult	2 11	0 5	
Dairy cattle	Calves Heifers Milking cows	0 11 22	0 4 5	
Swine	Piglet Adult Lactating	5 50 125	0 25 25	
Sheep	Lamb Adult	2 5	0 5	
Goats	Kid Adult	0 5	0 5	
Broiler chicken	Chick*100 Adult*100	1 9	1 9	
Laying hens	Chick*100 Laying eggs*100	1 15	1 15	
Horses	Foal Mature horses	0 5	5 5	

Service water requirements for different livestock types

Source: Chapagain and Hoekstra (2003).

Source: Chapagain and Hoekstra, 2003; UNFAO, 2006

Vast amounts of water are also required for maintaining livestock agriculture facilities and for servicing the animals in ways not related to drinking (Hutson et al., 2004; Chapagain and Hoekstra, 2003; UNFAO, 2006). Water is withdrawn for functions such as cleaning animal facilities, washing the animals, maintaining facility functions, and to aid in the production of animal products (such as milk). In intensive livestock facilities, such as that discussed in this thesis (CAFOs), the majority of service water is withdrawn for the cleaning and cooling of factories and facilities. Table 4 documents the service uses of water for various species of livestock (though it does not consider cooling requirements which, depending on the region, can be great).

One of the most intensive uses of water for servicing appears in the pork producing industry, where large amounts of water are required for the cleaning of facilities. On pig farms, a "flushing system" is used, whereby large amounts of water are flushed through the living quarters of the animals in order to clean manure (UNFAO, 2006). These "flushing systems" send the water to a storage basin, usually in a nearby lagoon (Field et al., 2001). The amount of water required for such a practice can be ten times that required for the drinking water of the pigs.

The UNFAO (2006) estimates that, based on the metabolic needs of species, the global annual water withdrawals for drinking water for livestock rests at 16.2 km³ and 6.5 km³ for servicing requirements (see table 5 and 6). However, aside from this, water is also required for the processing, packaging and production of meat and animal products. At every phase of the processing of these products, large amounts of water are required (see Figure 3). Largely, this is connected to the cleanliness requirements at various stages of the production process. The outcome of these practices is high volumes of wastewater which must be somehow disposed of.

Figure 3 Flow diagram for meat and animal product processing operations



Source: UNFAO, 2006

Global estimates of livestock water use only take into account the water used by animals for drinking purposes – thus, the estimate rests at 0.6 percent usage of all potable water (table 5 and 6) (UNFAO, 2006). Unfortunately, policy makers tend to use this figure when planning and making policies; thus, livestock agriculture is not considered to be a great user of water resources. The problem here is that the estimates do not take into consideration all the water used for servicing the animals and facilities, and for the processing of animal products. Further, their estimates do not often consider the depletion of water resources.

Water is also expelled after the servicing of livestock facilities as wastewater. The UNFAO (2006) reports that water for animal agriculture is the largest sectoral source of water pollutants. Pollutants may be point-source (observable pollution within a confined area) or non-point-source (pollution diffused throughout a larger area of a water body or bodies). Pollution due to livestock agriculture normally reabsorbs back into the natural environment in the form of either wastewater or manure. Livestock fecal matter contains large amounts of nutrients which alter the composition and PH of the water, as well as the balance of the ecosystem it rests in. Nutrients abundant in livestock fecal matter include nitrogen, potassium and phosphorus. Other impurities which appear in livestock feces, wastewater and manure include heavy metals, antibiotics, and pathogens (UNFAO, 2006). The result is an alteration of the water system, soils and ecosystem, often to the detriment of its long-term sustainability. Table 5 details examples of nutrient intake and excretions by different species of livestock.

Table 5 Nutrient intake and excretion by different animals

Animal	lr (kg	itake <i>i/year)</i>	Rete <i>(kg,</i>	ention <i>(year)</i>	Excretion <i>(kg/year)</i>		Percentage of N excreted	
	N	Р	N	Р	N	Р	form ¹	
Dairy cow ²	163.7	22.6	34.1	5.9	129.6	16.7	69	
Dairy cow ³	39.1	6.7	3.2	0.6	35.8	6.1	50	
Sow ²	46.0	11.0	14.0	3.0	32.0	8.0	73	
Sow ³	18.3	5.4	3.2	0.7	15.1	4.7	64	
Growing pig ²	20.0	3.9	6.0	1.3	14.0	2.5	78	
Growing pig ³	9.8	2.9	2.7	0.6	7.1	2.3	59	
Layer hen ²	1.2	0.3	0.4	0.0	0.9	0.2	82	
Layer hen ³	0.6	0.2	0.1	0.0	0.5	0.1	70	
Broiler ²	1.1	0.2	0.5	0.1	0.6	0.1	83	
Broiler ³	0.4	0.1	0.1	0.0	0.3	0.1	60	

Nutrient intake and excretions by different animals

¹ Assumed equivalent to urine N excretion. As mineral N is susceptible to volatilization, this percentage is often lower in manure applied on the land.

² Highly productive situations

³ Less productive situations.

Note: Owing to the variation in intake and nutrient content of the feeds, these values represent examples, not averages, for highly and less productive situations.

Source: de Wit et al., (1997).

Source: UNFAO, 2006

Based on assessments, the UNFAO (2006) estimates that in 2004 livestock excrement contributed 135 million tons of nitrogen and 58 million tons of phosphorus to the environment. The number one contributor of nitrogen appears to be cattle at 58 percent, followed by pigs at 12 percent and chicken at 7 percent (UNFAO, 2006). Table 6 illustrates the estimated relative contributions of pig waste, domestic wastewater and non-point sources to nitrogen and phosphorous emissions in water systems.

Table 6 Estimated relative contribution of pig waste, domestic wastewater and non-point sources to nitrogen and phosphorus emissions in water systems

Country/Province			Percentage contribution	on to nutrient emiss	ions in water systems
	Nutrient	Potential load <i>(tonnes)</i>	Pig waste	Domestic wastewater	Non-point source
China-Guangdong	N	530 434	72	9	19
	P	219 824	94	1	5
Thailand	N	491 262	14	9	77
	P	52 795	61	16	23
Viet Nam	N	442 022	38	12	50
	P	212 120	92	5	3

Estimated relative contribution of pig waste, domestic wastewater and non-point sources to nitrogen and phosphorus emissions in water systems

Source: FAO (200/d)

Source: UNFAO, 2006

Because of the abundant levels of nutrients it adds to ecosystems, the wastewater produced by livestock agriculture also increases the level of eutrophication in water bodies, helping to transition water bodies once rich in ecosystem health, into ecological dead zones (UNFAO, 2006). Coastal areas globally are retreating into dead zones and coral reefs are degrading and dying.

Eutrophication occurs naturally in water bodies, but is accelerated with the introduction of nutrients such as nitrogen from livestock wastewater into water systems. The excess amount of nutrients causes algae and plant blooms, resulting in excessive amounts of oxygen use in the ecosystem. This can then lead to "dead zones" where flora and fauna have difficulty growing due to ecological imbalances. As the UNFAO (2006) highlights: "If the plant growth resulting from eutrophication is excessive, algal blooms and microbial activity may overuse dissolved oxygen resources, which can damage the proper functioning of ecosystems. Other adverse effects of eutrophication include: shifts in habitat characteristics owing to change in the mix of aquatic plants; replacement of desirable fish by less desirable species, and the associated economic losses; production of toxins by certain algae; increased operating expenses of public water supplies; infilling and clogging of irrigation canals with aquatic weeds; loss of recreational use opportunities; impediments to navigation due to dense weed growth."

These changes occur in both marine and freshwater systems, and can also severely impact aquaculture, fisheries, and tourism (Environmental Protection Agency, 2005; Belsky, Matze and Uselman, 1999; Ongley, 1996; Carpenter et al., 1998).

Human health problems related to poorer water resources and water scarcity are also increasing. Furthermore, the abundance of antibiotics, hormones, tannery chemicals, sediments from eroded pastures, fertilizers and pesticides related to livestock agriculture is both increasing, and leading to complex negative health impacts on surrounding ecosystems (UNFAO, 2006). Water resources are also polluted by animal waste infiltrating water systems.

A further major impact of livestock agriculture is soil erosion and the resulting water pollution. Livestock agriculture contributes to 55 percent of total soil erosion in the United States (UNFAO, 2006). The erosion caused by agriculture reduces the ability of the soil on-site to hold water; off-site, the water run-off is polluted and contaminates streambeds, rivers, lakes, and other sources of freshwater resources. Impacts on water resources include: higher sedimentation levels in rivers, reservoirs and other water channels can clog and obstruct drainage, irrigation and other water related functions; the interference of aquatic habitats due to the increased sedimentation affecting streambeds and other water channels; the covering over of habitats such as coral reefs, nests and feeding sites with sediments, the obstruction of light in habitats, the increased turbidity of water making nesting, feeding and other activities difficult and lowering levels of light in aquatic habitats (needed for growth of plants and algae); the increasing of habitat temperatures which affects the digestion and respiration of aquatic animals; the disturbing of water flows in channels which may increase the chances of floods in wet seasons and droughts in dry seasons; the transporting of agricultural pollutants such as heavy metals, pesticides, and drugs which may be reabsorbed into new environments; the introduction of new micro-organisms which are protected by the sedimentation; and eutrophication (described earlier) (Ongley, 1996; Jayasuriya, 2003; Uri & Lewis, 1998; UNFAO, 2006).

Though soil erosion is a natural occurrence in any ecosystem, human activities such as agriculture have significantly increased the amount of erosion, to the point where myriad ecosystems are being negatively affected. Soil erosion increases the turbidity levels of water channels, as well as increase sedimentation downstream (UNFAO, 2006). Figure 5 illustrates the global risk of human-induced water erosion.

Figure 4 Risk of human-induced water erosion



Source: UNFAO, 2006

Undeniably, the impact of livestock agriculture on the hydrologic cycle, precious ecological habitats, as well as scarce water resources is great. As the UNFAO (2006) concludes:

"Overall, summing up the impacts of all the different segments of the production chain, the livestock sector has an enormous impact on water use, water quality, hydrology and aquatic ecosystems. The water used by the sector exceeds 8 percent of global human water use. The major part of this is water used for feed production, representing 7 percent of the global water use... the volume of water depleted through evapotranspiration of feed crops represents a significant share at 15 percent of the water depleted every year." (p.167)

In terms of water pollution contributed by the livestock agriculture sector, the UNFAO (2006) states:

"The volume of water depleted by pollution is not quantifiable, but the strong contribution of the livestock sector to the pollution process has become clear from a country level analysis. In the United States sediments and nutrients are considered to be the main water-polluting agents. The livestock sector is responsible for an estimated 55 percent of erosion and 32 percent and 33 percent, respectively, of the N and P load into freshwater resources. The livestock sector also makes a strong contribution to water pollution by pesticides (37 percent of the pesticides applied in the United States), antibiotics (50 percent of the volume of antibiotics consumed in the United States), and heavy metals (37 percent of the Zn applied on agricultural lands in England and Wales)." (p.167)

Table 7 gives offers a cohesive summary of the estimated contribution of the livestock sector to the water use and depletion processes.

Table 7 Estimated contribution of the livestock sector to water use and depletion processes

		WATER USE	
Dinking and servicing water		Global	0.6% of water use
		United States	1% of water use
		Botswana	23% of water use
Meat and milk processing, tanning		Global	0.1% of water use
Irrigated feed production (excluding forage)		Global	7% of water use
		WATER DEPLETION	
Water evapotranspired by feed crops (excluding grassland and forage)		Global	15% of water evapotranspired in agriculture
Nutrient contamination	Ν	Thailand (pig waste)	14% of N load
		Viet Nam (pig waste)	38% of N load
		China-Guangdong (pig waste)	72% of N load
		United States	33% of N load
	Р	Thailand (pig waste)	61% of P load
		Viet Nam (pig waste)	92% of P load
		China-Guangdong (pig waste)	94% of P load
		United States	32% of P load
Biological contamination		N.A.	
Antibiotics consumption		United States	50% of antibiotics consumed
Pesticide (for corn and soybean as feed) applied		United States	37% of pesticides applied
Erosion from agricultural land		United States	55% of erosion process
Heavy metal applied	Zn	England and Wales	37% of Zn applied
	Cu	England and Wales	40% of Cu applied

Estimated contribution of the livestock sector to water use and depletion processes

Source: UNFAO, 2006

6.C. Biodiversity

The UNFAO Livestock's Long Shadow report also sites livestock agriculture as a major contributor to the loss of species biodiversity worldwide (UNFAO, 2006). Livestock agriculture is a major driver of deforestation, leading to loss of habitats, migration corridors and resting sites for animals. Land use changes made for livestock agriculture are also a leading cause of land degradation, pollution, sedimentation of habitats along coasts, facilitation of the invasion of non-native species, and changes in biogeochemical cycles. Figure 5 maps the global change in biodiversity from the Enlightenment period, to today.

Figure 5 Biodiversity, as a ratio of species abundance, in 1700 and today





Biodiversity, as ratio of species abundance before human impacts

High impacts	0	-	25	
High-medium impacts	25	-	50	
Medium-low impacts	50	-	75	
Low impacts	75	-	100	%

Mean species abundance (%)

Figure 27: Loss of biodiversity with continued agricultural expansion, pollution, climate change and infrastructure development. (Source: GLOBIO; Alkemade *et al.*, 2009).

Source: UNFAO, 2006

The effects of livestock agriculture on biodiversity are far reaching, but difficult to measure. As the UNFAO (2006) states, "Losses are the result of a complex web of changes, occurring at different levels, each of which is affected by multiple agents." (p. 214) Though estimates of biodiversity loss contributed by livestock agriculture are difficult to make, the UNFAO (2006) Livestock's Long Shadow report states that hotspots offer a possible lens for looking at the problem through:

"The effect of livestock on biodiversity hotspots may indicate where livestock production is having the greatest impact on biodiversity. Conservation International has identified 35 global hotspots, which are characterized both by exceptional levels of plant endemism and by serious levels of habitat loss. 23 of the 35 biodiversity hotspots are reported to be affected by livestock production [see figure 6]. The reported causes are relate to habitat change and associated with the mechanisms of climate change, overexploitation and invasive alien species. Major reported threats are: conversion of natural land to pastures (including deforestation), planting of soybean for animal feed, introduction of exotic fodder plants, use of fire for pasture management, overgrazing, persecution of livestock predators, and feral livestock. The role of the livestock sector in aquatic impacts (pollution and over-fishing) is not singled out." (p. 215)



Figure 6 Livestock as an important cause for global biodiversity hotspots

Source: UNFAO, 2006

The report also cites an analysis by the IUCN Red List of Threatened Species:

"An analysis for this report of the IUCN Red List of Threatened Species, the world's most authoritative source of information on extinction risk, indicates that the 10 percent of the world's species which face some degree of threat are suffering habitat loss from livestock production. Livestock production appears to have more impacts on terrestrial than on freshwater and marine species, as the important effects of habitat loss and habitat degradation are most significant on land." (p. 215)

6.D. Climate Change

Climate change is considered to be, perhaps, the greatest risk to the human enterprise. Today, all of life's prospects are faced with the threat of rising ocean temperatures, melting icecaps and glaciers, drought, flooding, increasing temperatures, and other acute changes to the biogeochemical cycle.

Livestock agriculture is said to contribute an estimated 18 percent to global greenhouse gas emissions, the largest contributor of the five main sectors (energy, industry, waste, land use, and land use change and forestry and agriculture) (UNFAO, 2006). In fact, livestock contributes over 50 percent of anthropogenic greenhouse gas emissions to land use, and land use change and forestry and agriculture. Furthermore, livestock agriculture contributes more greenhouse gas emissions than all other forms of agriculture, at 80 percent. Livestock agriculture contributes a whopping 9 percent of all anthropogenic carbon emissions, up to 40 percent of all anthropogenic methane emissions, 60 percent of all ammonia emissions, and a whopping 65 percent of all anthropogenically-induced nitrous oxide emissions. Table 8 details the role that livestock agriculture plans in carbon dioxide, methane, and nitrous oxide emissions. The figures produced are mere estimates, and do not necessarily represent the long-term effects of all livestock induced change.

Gas	Source	Mainly related to extensive systems (10 ⁹ tonnes CO ₂ eq.)	Mainly related to intensive systems (10º tonnes CO ₂ eq.)	Percentage contribution to total animal food GHG emissions
CO ₂	Total anthropogenic CO ₂ emissions	24	(~31)	
	Total from livestock activities	~0.16	5 (~2.7)	
	N fertilizer production		0.04	0.6
	on farm fossil fuel, feed		0.06	0.8
	on farm fossil fuel, livestock-related		0.03	0.4
	deforestation	[1.7]	(0.7)	34
	cultivated soils, tillage		(0.02)	0.3
	cultivated soils, liming		(0.01)	0.1
	desertification of pasture	(0.1)		1.4
	processing		0.01 - 0.05	0.4
	transport		0.001	
CH4	Total anthropogenic CH4 emissions	Ę	5.9	
	Total from livestock activities	2	2.2	
	enteric fermentation	1.6	0.20	25
	manure management	0.17	0.20	5.2
N ₂ 0	Total anthropogenic N ₂ O emissions	3	3.4	
	Total from livestock activities	2	2.2	
	N fertilizer application		0.1	1.4
	indirect fertilizer emission		0.1	1.4
	leguminous feed cropping		0.2	2.8
	manure management	0.24	0.09	4.6
	manure application/deposition	0.67	0.17	12
	indirect manure emission	0.48	-0.14	8.7
Grand	total of anthropogenic emissions	33	(~40)	
Total e	missions from livestock activities	~4.6	(~7.1)	
Total e	xtensive vs. intensive livestock system emissions	3.2 (~5.0)	1.4 (~2.1)	
Percen	tage of total anthropogenic emissions	10 (13%)	4 (5%)	

Table 8 Role of livestock in carbon dioxide, methane and nitrous oxide emissions

Note: All values are expressed in billion tonnes of CO₂ equivalent; values between brackets are or include emission from the land use, land-use change and forestry category; relatively imprecise estimates are preceded by a tilde.

Global totals from CAIT, WRI, accessed 02/06. Only CO₂, CH₄ and N₂O emissions are considered in the total greenhouse gas emission.

Based on the analyses in this chapter, livestock emissions are attributed to the sides of the production system continuum (from extensive to intensive/industrial) from which they originate.

Source: UNFAO, 2006

Conclusion

Land use changes due to livestock agriculture have been extensive and have resulted in myriad negative effects on the natural environment. Effects are both point-source and non-point-source, direct and indirect. Major direct effects to the environment due to livestock agriculture include soil erosion, land degradation, water pollution, and changes in the hydrological cycle. The two major indirect changes to land are loss of biodiversity and climate change – both of which are linked to the deforestation that ensues to clear land, mainly for feed crops.

Changes to the land and biodiversity have been prominent since the Enlightenment period, as illustrated in figures 1 and 3. Behind every human activity is a philosophy or ideology that shapes human behaviour and choices. The western notion of humans and nature, which separates the two and places humans on a higher moral plane, has been a guiding dogma behind much of the major agricultural changes made to the planet since the Enlightenment. The result has been an increase in the amount of meat and animal products available for human consumption, a profound increase in animal suffering, and myriad direct and indirect detrimental impacts on the biosphere.

Chapter 7

Conclusion

The late western Enlightenment was a period of profound revolution in thought. Ideas about science, religion, and morals, as well as the spheres of the social, political, and economic, were dramatically altered. In this thesis, I have examined how certain ideas coming out of the Enlightenment have had a tangible influence on specific sectors of human activities today. The objective of my research has been to demonstrate influence between a set of ideas in the Enlightenment, and a broad historical trend leading to modern animal farming practices.

My research has connected three key thinkers in the western Enlightenment period and how their body of influence has been manifest in modern factory farming practices: Thomas Hobbes and the materialists; Rene Descartes and the dualists; and the influence of Newtonian physics on both classical and neoclassical economics.

The discussion of Thomas Hobbes relates to the dominant notion of human nature, and the way in which humans are conceived to behave in a natural state. Hobbes' concept of the state of nature is foundational to the political economy that stemmed from the Enlightenment, and it influenced the formation of the modern neoclassical market. Today, drawing from the original formulation of man in the "state of nature," humans acting in the market have become *homo economicus*. It can be argued that Hobbes state of nature became a self-fulfilling prophecy: man has been conceived to be materialistic, hedonistic, individualistic, all the ingredients of a narcissist. In a sense, this is just what he has become. Moreover, *homo economicus* is produced and continually reproduced by the market. Citizens in the western world are raised to believe that they are consumers first and foremost. Therefore, having characteristics such as insatiability, greediness, and selfishness are legitimated – they enable a person to function in the market and add to its growth. Unfortunately the characteristics of humans legitimated by the market come at the expense of ecological wealth and animal welfare.

Hobbes' state of nature and the general materialism that he held in Leviathan were concepts profoundly influential to subsequent Enlightenment thinkers. The state of nature signified a dramatic departure from previous conceptions of the nature of human being (Ophuls, 1997). Narratives on the nature of the human predating Hobbes often tended to emphasize the importance of the collective whole over the individual. But key thinkers following Hobbes drew from his work and used the formula of humans as selfgratifying, self-preserving, individuals, devoid of moral virtue in the absence of political boundaries, to frame their political economy. Notable examples include Locke, who used the state of nature as the framework for human nature in the formulation of his property rights; as well as Smith, who legitimized the state of nature by using it as the canvas upon which to lay his "invisible hand" theory in particular, and market economy theory in general. He too believed that it was both natural, and morally correct, for individuals to pursue self-interest. This, to Smith, was what created general societal harmony (Ophuls, 1997).

My main argument surrounding Hobbes was not that his *Leviathan* was *causative* for modern industrial factory farming, but rather, that his state of nature implemented a strong *influence* on modern economic activities, factory farming being an example. Much literature exists on the foundational influence that Hobbes' state of nature had – Leviathan having been written during the birthing period of modern political economy. As Myers (1983) notes, Hobbes was the first to identify the contradictions between human nature and human welfare, but Smith was the political philosopher who ultimately resolved it. In other words, Smith inverted the state of nature to represent its benefit to society through the invisible hand. As Taylor (2010) (quoting Myers [1983]) highlights:

"For Myers, Hobbes is a seminal figure in the development, if not the founding, of classical economics. His contribution was both "positive" and "negative." On the positive side, "Hobbes is important for attracting serious attention to the principle of self-interest, and for inducing minds to come forth with new ideas about the principle" (1983, 28–29). Furthermore, his treatment of self-interest in both its material and its mental aspects gave rise to explorations into the economic as well as the psychological bases of human motivation. It was Hobbes, "more than any other [thinker,] who, originally, stimulated these discussions of self-interest". (p.3)

Ultimately, it can be argued that Hobbes laid the foundations for *homo economicus* by abstracting human motivations. Descartes, however, falls into a very different discipline. Rather than being associated with political economy, he is in line with the foundations of natural philosophy. This is exactly why I draw him into my thesis: while Hobbes theorized about humans in their natural state, Descartes theorized about the sharp division between humans and nature. The Cartesian mechanistic physiology laid the moral foundations for the technical human conquest over nature, which continued to expand in the centuries leading up to today, notably the industrial revolution.

Indeed, Descartes, dubbed the "Father of Philosophy," was another key thinker with profound influence on the Enlightenment and the dominant narratives to spring from it. The Cartesian mechanistic physiology served as a rewrite of the human-nature narrative. Descartes theorized that all that existed was mind and matter, and only humans, God and other spiritual beings had mind. All that existed outside of the realm of mind was matter. To Descartes, all else in the material realm was inanimate. Any movements or activities stemming from different material bodies, including that of animals and plants, constituted no more than mere reactions to stimuli. In this sense, Descartes conceived of the entire material world of nature as merely automata, functioning solely as a reaction to the movement of things in the material world. "Nature as machine" constitutes the conception of the non-human environment popularized by Descartes, and with it followed a profoundly impacting tradition for centuries to come.

The issue here is that if any material body outside of the human mind (the "extension" of things) is considered to be nothing more than automata, then man is placed on a higher moral plane than other beings, and has the moral grounds for exploiting all other earthly bodies. The perceived ability to feel pleasure and pain, which, only humans were thought to have, was one of the main characteristics that distinguished humans from the rest of nature theoretically. Before Descartes, the capability of feeling positive and negative sensations was thought to distinguish all animals from plants in western lore (Garner, 2003). This notion served as moral grounds for the avoidance of the infliction of pain on animals by humans, except in situations of necessity (e.g. slaughtering an animal for meat) or for religious practice (e.g. the sacrificial lamb). By eliminating sentience, rationality and the ability to think independently, Descartes eliminated man's moral obligation to be the protectors or stewards of nature. Indeed, he eliminated the necessity for humans to grant any moral considerations to nature and all its living entities whatsoever.

For Hobbes, the idea of personal sovereignty and material satisfaction, which he made the ends to his political economy, implied a theme of human domination over nature (Ophuls, 1997). The domination of man over nature was also an explicit theme in Cartesian natural philosophy. Using science and technology, humanity has become the master of nature and has transformed animals into commodities.

The modern market reproduces these practices in various amalgamations – for the animal farming industry, it has 'progressed' to the point of ecocide. Today, numerous components of the ecosystem are in overshoot due to animal agriculture. Scientists have found both direct and indirect negative effects on the biosphere due to animal agriculture including the pollution of water, eutrophication, nitrogen overshoot, soil erosion, land degradation, climate change and loss of biodiversity.

Indeed, the neoclassical market is the canvas upon which the cruel practices of modern factory farming, and the unsustainable and unethical practices of livestock agriculture in general, are woven. The neoclassical economic structure derives from classical economics, where Newtonian principles and equations were translated into social and economic "laws". But if the central objective of the market is to increase the common good, then the neoclassical market system is a failed system, for the way in which this "good" is reached causes tremendous amounts of suffering.

The use of instrumental reason (which manifests itself most apparently in bureaucratic and technological management) paired with the freedom to pursue one's own desires, have caused the rationality upon which the market is based to abrogate and turn upon itself (Horkheimer and Adorno, 1944). Ironically, the outcome is completely irrational – an economy, society, and environment that is based on the endless destruction of life and profound amounts of suffering. It is not sustainable. The economic system only continues to legitimize and reinforce the false doctrines of Hobbes and the materialists and Descartes and the dualists, both of which lead to negative outcomes for others (both humans, non-humans and the ecosystem in general).

But revolutions in societies can and do take place, most often when there is a disconnect, a bitter divide, or a deeply laden problem at hand. Factory farming is only one example of the many ways in which certain assumptions and ideas stemming from the Enlightenment have shaped human behaviours and activities today. The implications of Hobbesian and Cartesian theories, and of neoclassical economics, have been profound and far reaching factory farming is just one piece of the ecologically disordered pie we are living in.

7.A. Next Steps

Today, there is a burgeoning body of literature on the human, animal and environmental injustices associated with the overshoot of global ecological limits due to human activities. Our dominant human narrative and neoclassical market have proven to be a failure – leading to the destruction of myriad realms of the natural environment. A new narrative of the human self, how humans relate to nature, and how activities ought to be conducted in the marketplace, is desperately needed. There are pockets of hope in certain burgeoning disciplines, such as the pre-paradigm of ecological economics, as well as complex systems theory and thermodynamics. Alternative human narratives drawn from diverse ethnicities also offer a glimpse of hope in the face of uncertainty.
Ultimately, what is needed is an acknowledgement that, in Schrödinger's words "individual consciousness is merely a manifestation of the unitary consciousness pervading the universe," (Schrödinger, 1944). This idea is related to a common theme in many eastern cultures; that of "Namaste" which is a greeting in Hindi but which translates roughly into "we are all one." Similarly, in Taoism, the Tao is the ephemeral force that unifies all living and non-living things. At the nadir of this narrative would be recognition that all biota and abiota from the past, present and future of the cosmos are in some way unified. These are also the grounds for extending ethical considerations to all things in the Biosphere, and indeed, the cosmos.

Once this higher state of ethics has been reached, whereby intergenerational and interspecies considerations are granted a higher status, humans will be in a better position to promote the flourishing of all life, not just the lives of a select few within the human species. This will require a profound rethink, and indeed, rewrite, of our human narrative and the goals of our human enterprise. In other words, we need to deeply reconsider what it is that makes us human, and what the goals of humanity ought to be.

ADDENDUM

In this thesis, I endeavoured to link correlations between Enlightenment narratives on humans and nature with their tangible manifestations in modern landscapes. Factory farming proved to be a fitting and ideal case study for a number of reasons. The state of modern animal agriculture indicates a connection between ideologies and praxis, and a fundamental disconnect between these ideologies, and the natural boundaries and limits of the biosphere. Undoubtedly, the topic of discussion reaches further than can be fully appreciated within the page limit of a Master's thesis. There are still implications and manifestations that are deserving of more investigation. The purpose of this addendum is to indicate further lines of inquiry and research.

Firstly, an extended literature review would have been ideal. For instance, covering both the original texts of philosophers and great thinkers, as well as published commentary on these thinkers. Hence, a broader exploration of what other scholars said of the chosen philosopher's works, and their commentary on how this underpins many agricultural approaches, would have been valuable.

Examining alternative narratives and philosophies at the time would be constructive. For example, Jean-Jacques Rousseau (1712-1778), French revolutionary and romanticist, had a vision of what the true nature of the human was which sharply contrasted that of Hobbes. Rousseau believed in the intrinsic goodness of humanity when in their natural state, or, before being positioned in a "civilized" state. However, he believed that social ties and society in general, in fact, corrupted humans. In a similar vein, why competing philosophies did not prevail over the thinkers selected also deserves further investigation. For example, an examination of why Rousseau's works on humans in their natural state gained less presence in the political and technological realms than did the Hobbesian state of nature. Overall, an expanded literature review with methodical survey on the continuing discourse on the issues and phenomena at hand would be ideal for future inquiries.

Without a doubt, there are a variety of human-nature narratives that shape agricultural practices around the world. The diversity can be related back to different societies, histories, religions and philosophies. The Maasai pastoralists offer a fantastic example of a completely alternative notion of animals and their relation to people. Rather than treat their cattle as objects in the western sense, and themselves as subjects, the Maasai treat their cattle also as subjects. They raise calves within their homes, identify individual tribesmembers with individual cattle, and even give individual cattle formal names. The relationship between the Maasai and their cattle is interesting and complex, but beyond the means of this thesis. To scratch the surface, cattle are not only a part of families and tribes, they also serve as sacrificial gifts to the gods, marriage gifts to other families, status symbols and symbols of strength and stability, investments, and currencies. The point here is that there are many other remarkable examples of human-non-human relations that deserve further exploration and comparison to the western model.

As a final point, there are many variations in the western animal agriculture industry; many improvements have been made to it in certain regions in the last several decades. For instance, agriculturalists have reacted and responded to consumer concern over animal welfare in a number of ways. The organic farming movement encompasses the certification of farms deemed organic. In British Columbia, for example, to earn a B.C. Organic certification, farmers must provide evidence and agree to ongoing evaluations

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that they are meeting the B.C. Organic certification standards. These include growing food on land that has been pesticide-free for at least seven years and giving more room than is typical in a factory farm for animals to move about and live. The rising popularity of this form of farming to consumers stems from a rising concern over the ecological and animal welfare implications of the standard factory-style farming model. Other notable examples of variation in the west include Compassion in World Farming (CIWF), a non-profit farming animal welfare charity based in the U.K., which aims at improving the living conditions of farming animals. CIWF has been successful in altering legislation in the E.U. with a number of farming practices, including the banning of sow stalls in the U.K. as of 1999, and the E.U. Directive on Laying Hens which banned barren battery cage housing for egg-laying hens in the E.U.

In summary, much remains to be explored with regards to the connection between historical philosophies and dominant ideologies, and modern day praxis. This thesis serves as one piece of the theoretical study of human-nature approaches in the context of an industrialized society.

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